for . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

HEATING AND VENTILATING

The Air Conditioning Monthly

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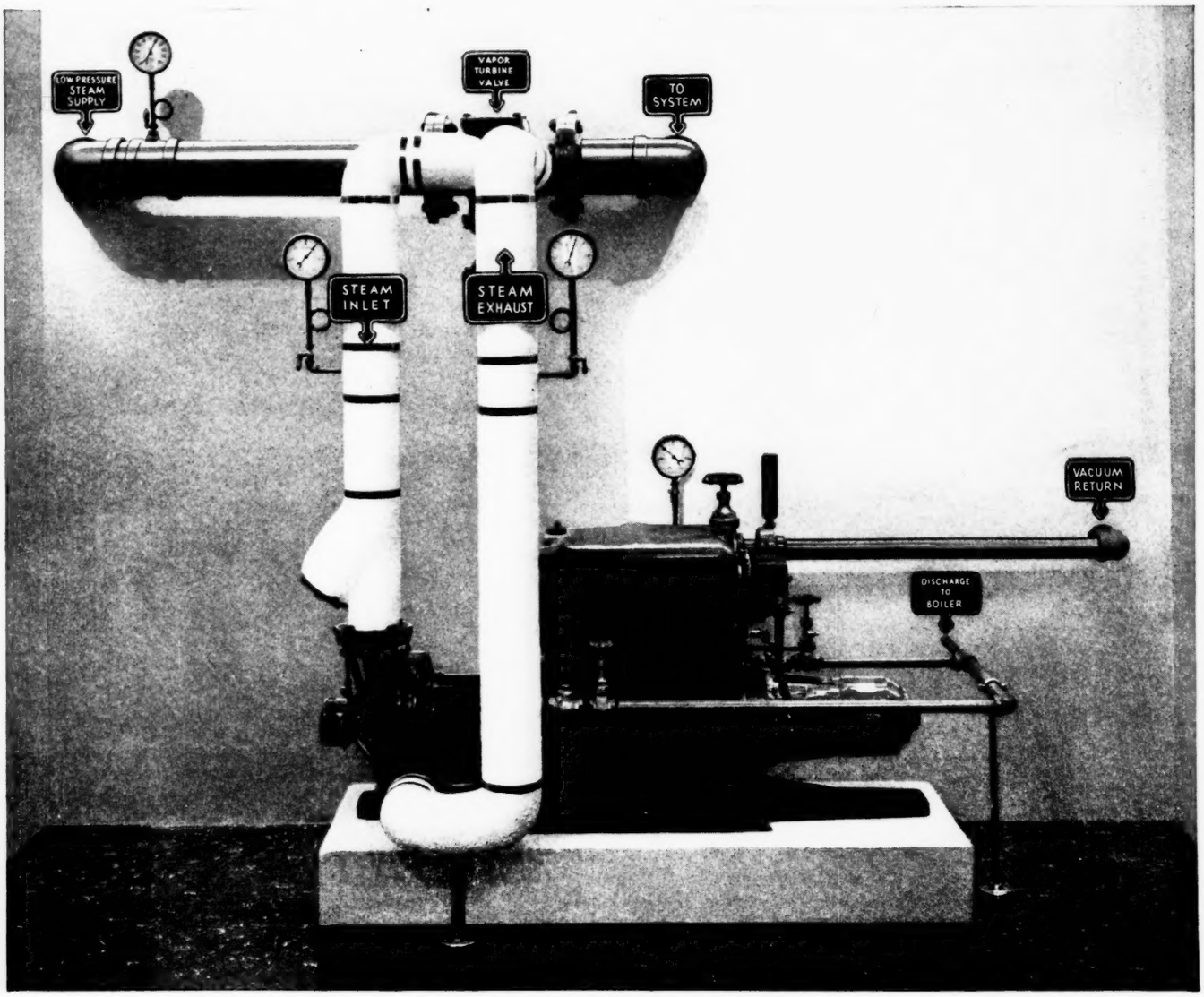
Where Heat Must Not Fail— Install this SAFE Heating Pump!



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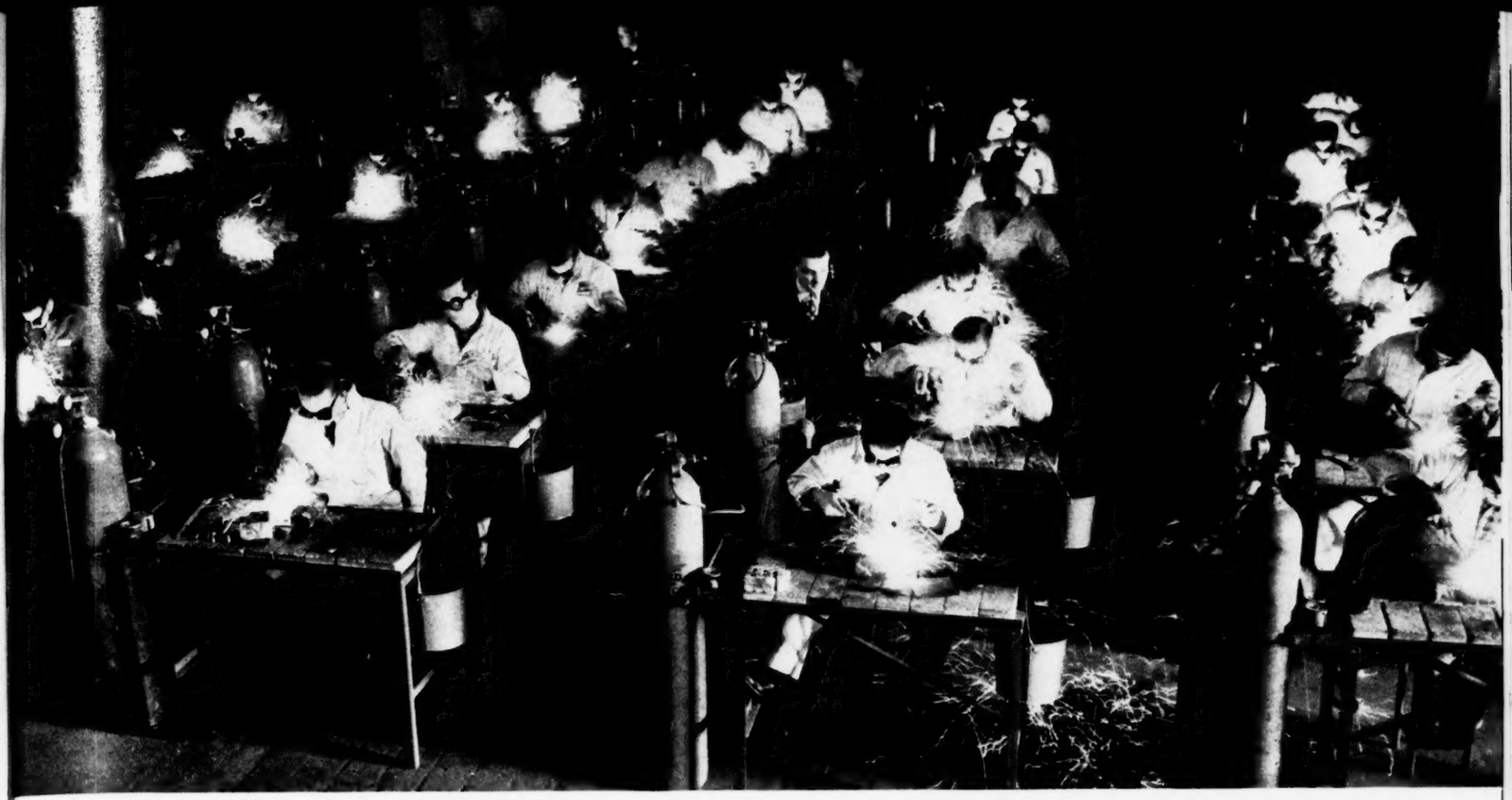


AIR CONDITIONING FOR AIR DEFENSE

Heating New York's Academy of Aeronautics

By HAROLD S. BIRKETT†

WHEN the Casey Jones School of Aeronautics of Newark, New Jersey, planned to open a school for the training of aviation mechanics at LaGuardia Field in Jackson Heights, New York, the architects and engineers of the New York City Dock Department were called upon to design a school building which would meet the Approach Zoning requirements of the Civil Aeronautics Administration. In order to minimize flying hazards, these requirements limited the building to two stories in height without projecting chimneys.

The heating of the Academy of Aeronautics—which the Casey Jones group has chosen to call its New York affiliate—presented a problem to which the use of gas fuel offered an ideal solution. The demands imposed in heating a long low building with a large percentage of glass area, and in which the several spaces required varying heating schedules, were, in many respects, unusual. The wide flexibility, economy, and ease of control provided by a multiplicity of gas fired heaters enabled the designers to meet these demands in a manner that could not be accomplished as well by other combinations of heating equipment.

The school is situated on high ground overlooking the airport. It is irregular in shape, 416 ft. long and 116 ft. wide at its greatest dimension. Frame work is of welded steel construction throughout, with columns set back to give an uninterrupted expanse of windows. The window area, representing 35% of the exposed wall surface, admits a maximum of daylight and permits a free view of the airfield on the north side. This, however, imposes a greater load on the heating plant.

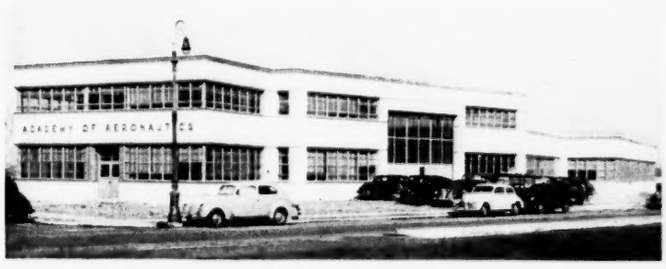
The walls are of 12 in. brick in which the outer course of face brick is buff in color with iron spot trim, to conform with neighboring airport structures.

The floors, for the most part, consist of a 1 in. grano-

†Engineering Div., The Brooklyn Union Gas Co., Brooklyn, N. Y.

Fig. 1. Front entrance of the Academy building which comprises the offices, classrooms, and shops.

Fig. 2. The dormitory south of the Academy has been constructed to provide living quarters for 300 Army men.



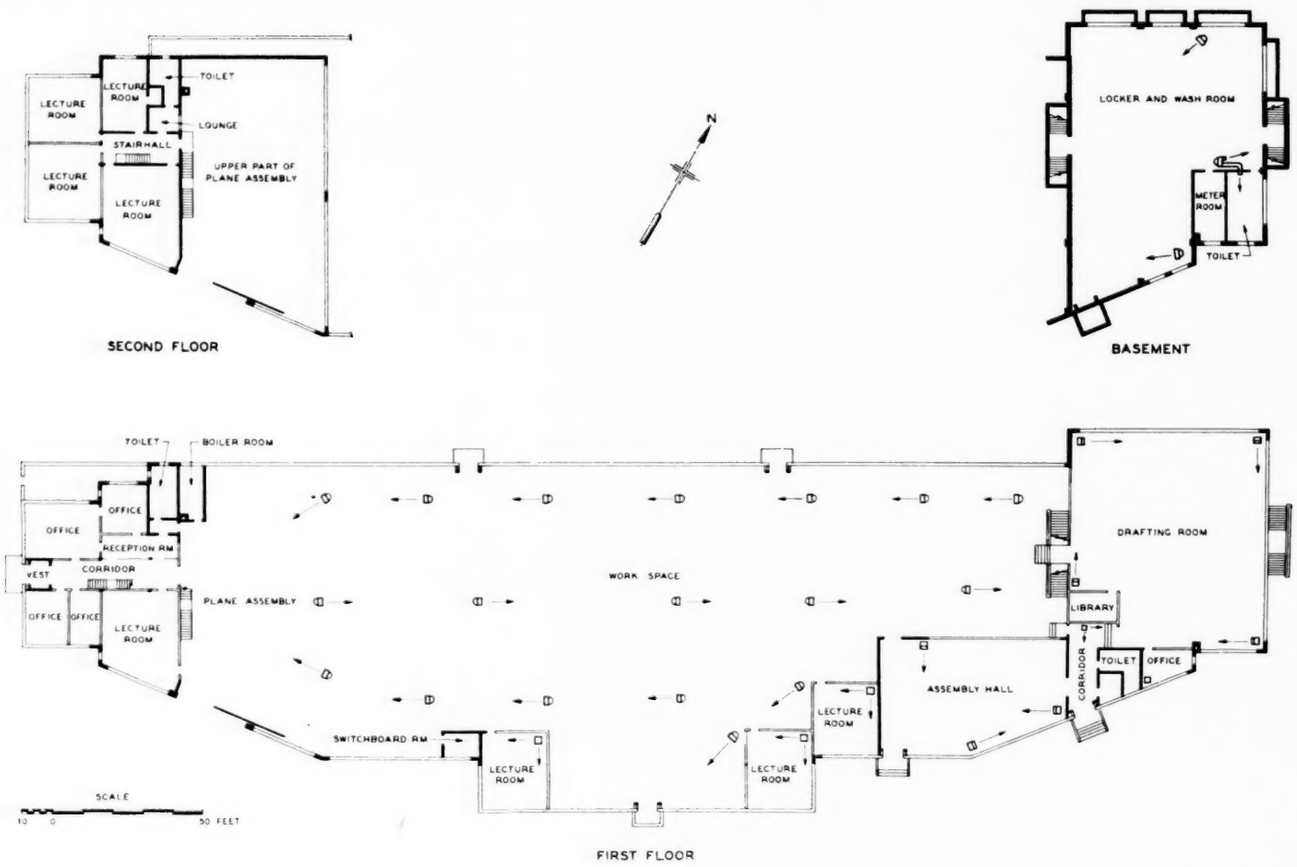


Fig. 3. The floor plan of the Academy shows three sections each heated by different means: the two-story section on the left, the large work space in the center, and the drafting and lecture rooms on the east end of the building.

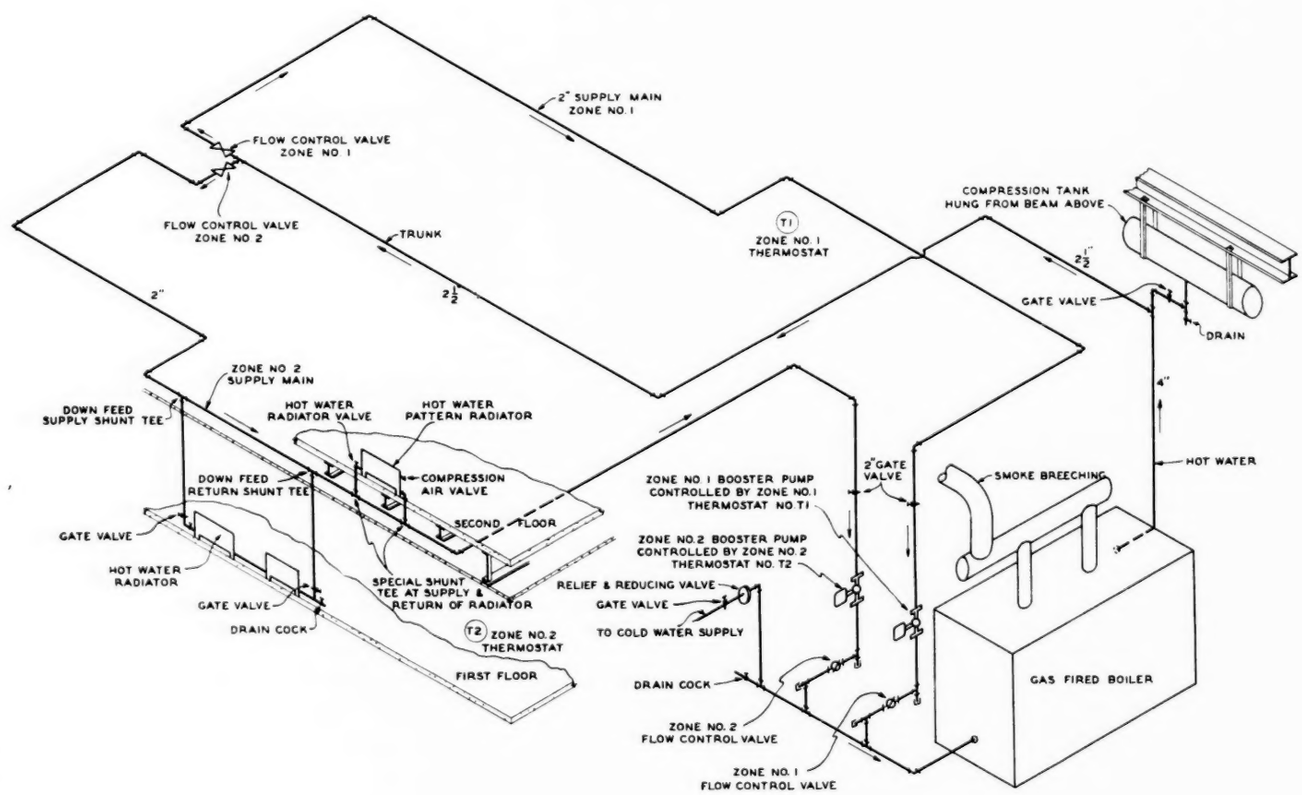


Fig. 4. Isometric drawing of a one-pipe hot water system showing the north and south zones supplied through independent circulators. Risers to the radiators on the second floor are up-feed and those supplying radiators on first floor are down-feed.

lithic wearing surface applied to a 4 in. reinforced concrete slab laid on a 6 in. tamped cinder bed. The roof is of U. S. Gypsum Company 3 in. Weatherwood Pyrofill with a 1-in. insulating board applied to the under side.

In all, the volume of heating space is nearly 700,000 cu. ft., requiring a heating plant having the equivalent of 19,400 sq. ft. of steam radiator surface.

The academy building may, in general, be divided into three sections: (1) the two-story west wing, in which the Administration and Clerical Offices and a lecture room are located; (2) the large one-story work space, 300 ft. long and 116 ft. wide; and (3) the one-story east wing, in which the drawing and lecture rooms are located, with the locker and meter rooms beneath occupying the only excavated portion of the building. These spaces are shown in Fig. 3.

The two-story west wing is made up of a number of small rooms, compactly arranged, in which people are seated the greater part of the time. Here, the usage clearly indicated the need for radiation supplied by a small boiler, locally situated. A Bell & Gossett one-pipe forced circulation hot water system was provided, which was divided into two branch circuits as shown in Fig. 4 and each circuit supplied with its respective circulator. One circuit comprises the radiators on the north wall and part of the west wall of both the first and second floors, supplied through down and up feed risers respectively connected to a common main. A similar circuit was made up of the radiators on the south wall and the balance of the west wall.

Independent control for these two zones was highly desirable to compensate for the varying heating effect of the sun on the large glass area facing south, and the simultaneous cooling effect on the northern exposure of prevailing winds from the northwest.

Each circulator is controlled by a separate clock type thermostat. When both thermostats are satisfied, and consequently both circulators stopped, the burners on the gas-fired boiler are automatically turned off. When the boiler is in operation, the boiler water under a pressure of about 15 lb. is maintained at 220F, giving the hot water surface about the same rating as for 1 lb. steam. A temperature of 72F is maintained at the thermostat for 14 hours daily. This is dropped to 65F at night.

The choice of a compact Janitrol gas designed boiler permitted the construction of a small boiler room in a corner of the work space. Since only a balanced draft is necessary, forced draft fans were not required, nor was it necessary to carry the chimney above the parapet. This permitted compliance with the approach zoning requirements of the CAA.

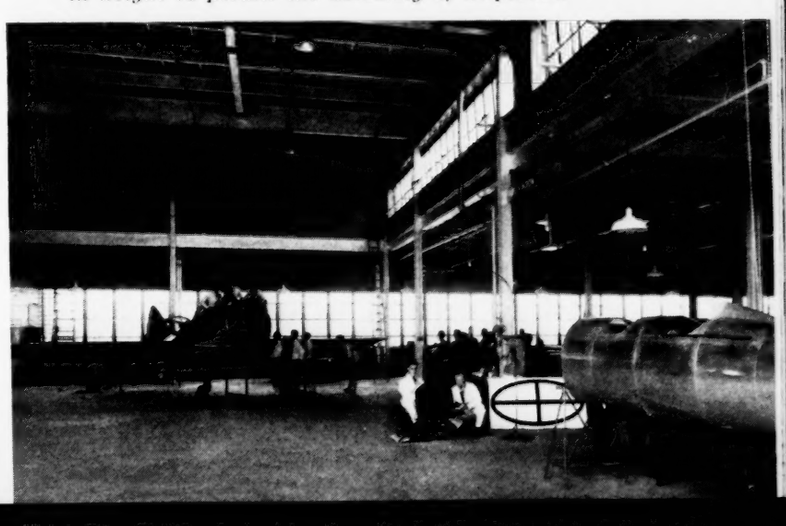
For the work space and locker room, Humphrey gas fired unit heaters were chosen. These heaters have been approved by the City of New York for use in airplane hangars, garages, and in spaces where inflammable liquids are sprayed. Twenty-one unit heaters were suspended from the steel work supporting the roof, and vented through the roof of the structure with Transite flue pipe as shown in Fig. 9. Each heater has an input of 200,000 B.t.u. per hr., 82% of which is delivered to

Fig. 5. A view of the one-story work space, 300 ft. long, showing the suspended gas-fired unit heaters.

Fig. 6. One of the drawing rooms showing the heat tower from which warm air is distributed along the adjacent walls.

Fig. 7. (Above) Another view of the work space showing several heaters.

Fig. 8. (Below) This portion of the work space is two stories in height to permit the assembly of airplanes.



the heated space. This high heat delivery is an inherent feature of this type of heater since the only loss is through the flue, eliminating the usual boiler and line losses characteristic of a central system.

The location of the heaters is such that the exposed walls and entrances are blanketed with hot air from the units. Each pair of heaters is controlled by a single thermostat mounted on an inside column. This arrangement has made it possible for the school authorities to install partitions to segregate the various shop activities without affecting the uniformity of temperature in the work space. The temperature in this space is maintained at 65F 24 hours daily. Should only part of the work space be in use, the temperature in the unused portion may be reduced if desired. It is intended that the fans on these heaters shall be used in the summer time for air circulation.

The drafting room and assembly hall in the east wing are heated by gas fired Janitrol vertical winter air conditioners, one of which is shown on Fig. 11. For the lecture room, lobby, and lavatories, Humphrey gas fired Heat Towers were chosen with hot air ducts leading from the heat towers to small adjacent rooms. One application may be seen on Fig. 6. These winter air conditioners and heat towers were specified for the lecture rooms and assembly hall, where quietness is essential, because they are equipped with slow speed multi-blade fans. Return air intakes near the floor cause the warm air, discharged horizontally from the top of the units, to seek the floor, and thus eliminate a normally cold condition at this level. This is a desirable feature for rooms where people are seated for long periods. The heaters are vented with Transite flue pipe in a manner similar to the suspended type unit heater. The enclosure of the flue pipe in a sheet metal housing extending from the top of the heater to the ceiling, as shown in the photographs of these units, lends a pleasing appearance to the heater installation.

Here again local thermostat control is provided for individual heaters to compensate for varying heating demands.

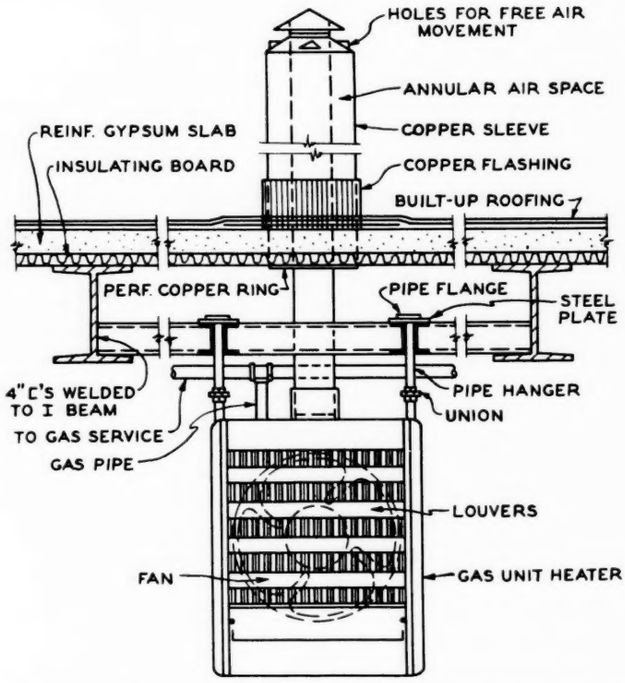
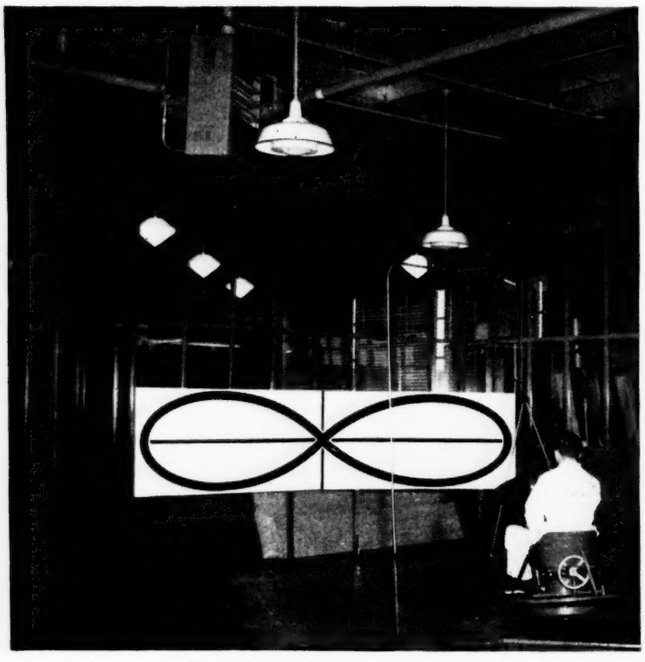
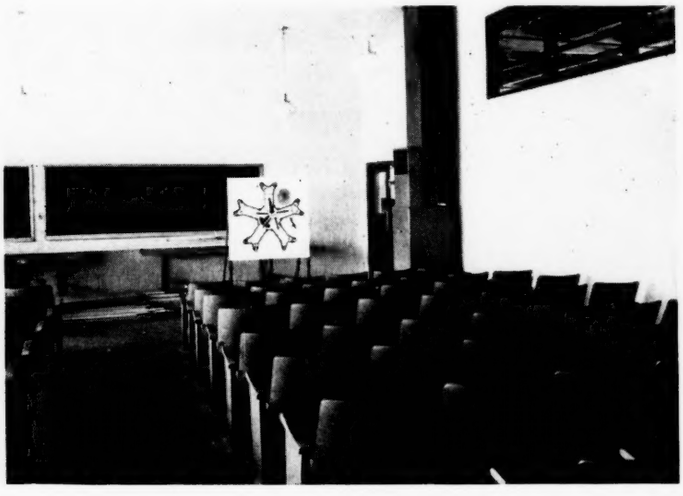


Fig. 9. The method used to suspend and vent the unit heaters. Note the use of the outer copper sleeve and the inner Transite flue pipe.

Hot water used by the students is supplied by a Ruud gas-fired No. 200 Multicoil heater connected to a 200 gal. copper tank, which is located in the meter room. Hot water for the office employees is provided by a 75 gal. Crane gas fired automatic storage heater, located in the boiler room adjacent to the offices. The versatility of application provided by individual gas fired units is again demonstrated in this instance. Each heater has been placed near the point of water usage to eliminate costly line losses over a distance of 400 ft. separating the points of application.

Fig. 10. (Left) The Link trainer which is available for use by the students gives one the 'feel' of an airplane. Fig. 11. (Below) The large assembly room heated by three forced warm air furnaces one of which is shown near the door.





Dormitory

A second permanent building, architecturally similar, has been constructed directly across the street from the academy to provide living quarters for 300 students from the Army Air Corps who will be trained in Aircraft Mechanics. This building, two stories in height, and covering an area 160 ft. by 130 ft., is owned and operated by the academy authorities. Should the need for these quarters as a dormitory become unnecessary at a future date, it is the intention of the owners to convert the building into an apartment house for use by employees at the airport. The dormitory has been constructed with this plan in mind.

In this building two gas-fired Richmond hot water boilers, having a combined capacity of 16,700 sq. ft. of hot water radiator surface, have been installed to supply a Taco one pipe forced hot water circulating system. Here the piping has been arranged to provide three heating zones, comprising the radiators on the northern, southern, and western exposures respectively.

Water heating for the 48 wash rooms with showers in the dormitory, and for the restaurant kitchen on the first floor, is provided through a Taco instantaneous coil coupled with an 80 gal. reserve tank. Normally this water is delivered at 140F. Water at 180F for the dish washer and for sterilization purposes is provided by means of a small Burkay gas-fired instantaneous water heater, situated in the restaurant to boost the house supply from 140 to 180F.

Before deciding to install gas-fired equipment, consideration was given by the engineers to all fuels and to many systems of heating. A study was made of all items of expense incidental to the installation and operation of the heating plant. This study showed a saving in first cost of nearly 50% which was reflected in low carrying charges and amortization expense. Operating attendance and maintenance costs, also, were found to be negligible. These savings were more than sufficient to offset the higher cost of gas fuel.

Other factors favored the use of individual gas fired units, such as the elimination of forced draft equipment and condensate return pumps, which would have been necessary with a central steam system. Long runs of large insulated steam and return piping with necessary trenching would have been required because of the location of the boiler room at one end of the building. Considerable floor space, which would have been demanded for a large boiler room, was saved, and an oil tank buried in filled ground was avoided. The dependability of gas fuel supply was another consideration, as well as the service maintained by the local gas company, which is available at all hours.

The estimated fuel consumption upon which the original cost studies were based was 9,600,000 cu. ft. of 540 B.t.u. gas for the academy, and 5,700,000 cu. ft. for the dormitory. It is interesting to note that the actual gas usage has been below the estimate by 11% for the portion of the season through January.

Actual experience to date shows that the system is simple, flexible, and economical in operation; and, with gas company service, is free from care.

Note: The academy building was planned and built under the direction of the Dept. of Docks, City of New York. Design of the dormitory was by Cherry and Matz, architects, New York City.

Noises in Air Conditioning Systems

While noisy jobs in air conditioning installations are not frequent, running perhaps one in twenty, it is good business to correct all faults, especially those causing noises in ducts. There are no absolutely silent fans. They must all produce some vortices or eddies, which are responsible for the noises. A very small reduction of intensity of these eddies can cut the audible noise in half. These statements were made by H. F. Hagen of the B. F. Sturtevant Company in a talk before the Boston chapter of the ASHVE recently. Abstracts follow:

Noises may be placed in two categories. One is a sort of swishing noise, rising up to a whistle. It is very penetrating and insistent and makes a room where it is heard very unpleasant, filling the whole room. Such noise can readily be absorbed by lining 20 ft. of the air duct back from the fan. This will eliminate the noise in most cases.

I have in mind two jobs handled by the same corporation. One had the ducts soundproofed to a distance of 30 ft. from the fans, and there was no noise. The job was perfect. In the other case, using the same type of fans, by the same manufacturer, there was a terrific noise, because there was no soundproofing. Later soundproofing was added and the noise was eliminated.

The second type of noise is a rumble, due to low frequency, as the sharp, swishing or whistling noises due to high frequencies. This second type hardly seems to be an air noise, and is often mistaken for mechanical trouble; but it is really an air noise, and like the first type, is caused by action of the fan blades on the air. Rumble is more difficult to eliminate, as it is irregular and easily masked by normal activities within a building. When this is so, and the rumble is lost in other ordinary noises, complaints about it disappear. Up to 1½ of static pressure, there is no appreciable noise. In air conditioning, however, static pressure sometimes goes up as high as 4½. Other cases of noise require the services of a skilled acoustician. An inch-thick blanket of glass or rock wool will eliminate most noises —if the blanket is arranged in a network like the form of an egg crate. This blanket should be not less than 12 ft. long to be effective, and the squares should be one-third of the wave length of the noise to be absorbed.

Power Requirements of Ammonia Compressors

By WILLIAM PARKERSON

IN making a study of the power use of various departments in industrial plants or other applications where ammonia compressors are used it is necessary to know the horsepower required to drive the compressor. Most of the data available at the present time is in the form of horsepower per ton of refrigeration and is therefore not suitable for this purpose since the amount of refrigeration being produced is usually not known.

What is needed in these cases is a chart which gives the brake horsepower from simple observations such as compressor speed, head pressure, suction pressure and compressor size. With this thought in mind the chart below was prepared.

On the right half of the chart is plotted the piston displacements of various compressor sizes when operating at different speeds. In the center section of the chart is plotted the various compressor efficiencies from 60 to 100%, while the left section shows head pressure, suction pressure, brake horsepower per cubic foot per minute of gas circulated and brake horsepower.

Efficiency

With regard to compressor efficiency a study of manufacturers test data shows that a compressor in good condition may be expected to have an efficiency of about 90%. This, therefore, can be taken as the optimum efficiency.

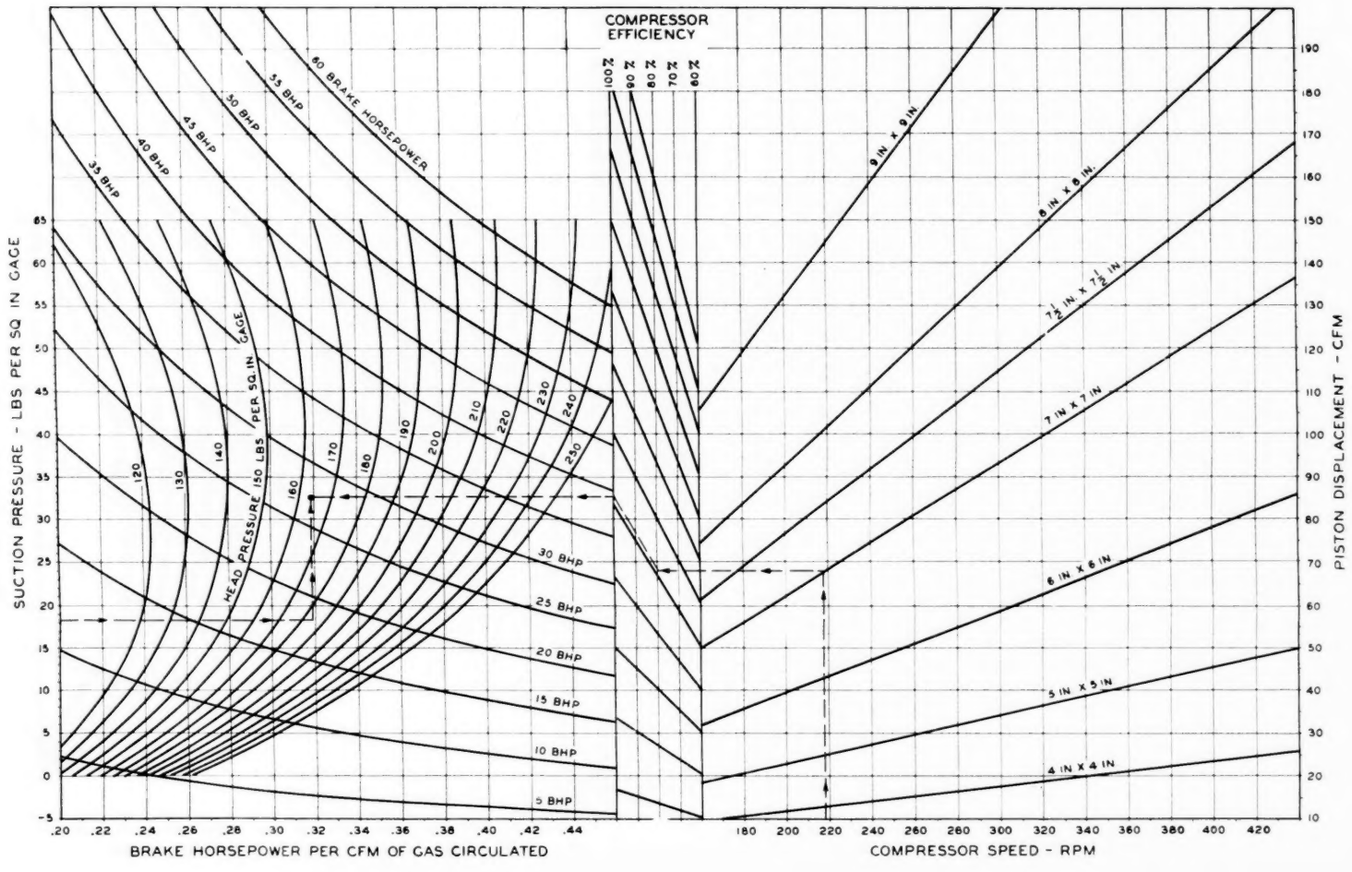
Example

The following example will serve to illustrate how the chart is used:

Suppose a 7 in. x 7 in. ammonia compressor is operating at a speed of 218 R.P.M., the suction pressure is 18.27 lb. per sq. in. and the head pressure is 185 lb. per sq. in. What is the brake horsepower? The efficiency is taken as 80% in this case.

The chart is entered on the right side at 218 R.P.M. and a straight line is drawn up to the 7 in. x 7 in. compressor line. A horizontal line is drawn left until it intersects the 80% compressor vertical line. From here the diagonal lines are followed left to the left chart. A horizontal line is then drawn across the left chart.

The suction pressure (18.27) is then found on the left side of the chart and a horizontal line is drawn until it intersects the 185 lb. head pressure line. From



this point a vertical line is drawn to the horizontal line determined from the compressor speed and size. The point of intersection then gives the brake horsepower as 27.

Construction of Chart

Since no one likes to use a chart without a knowledge of the groundwork upon which it is founded, the derivation of the chart follows.

The right-hand side of the curve is merely a chart of the equation

$$\text{C.F.M.} = \frac{\pi B^2}{4} \times \frac{S \times \text{R.P.M.}}{1728} \times C = D$$

for various common compressor sizes. Straight lines for additional sizes may be easily drawn in.

The left-hand side of the curve is not quite so easy. First—and quite simple—the horsepower curves, which slant downwardly from left to right, represent the product of "Piston Displacement" and "B.H.P. per C.F.M. of Gas Circulated." For instance, the product of 100 C.F.M. of piston displacement and .25 B.H.P. per C.F.M. of gas circulated determines a point on the 25 B.H.P. curve. The apparent disharmony between piston displacement and gas circulated will be explained later.

For the other family of curves on the left-hand side, the table was prepared. The figures in this table were calculated from the equation

$$P = \frac{\text{T.H.P.}}{\text{C.F.M.}} = \frac{144}{33{,}000} \times \frac{k}{k\text{-}1} \times P_s \left\{ \left(\frac{P_H}{P_s} \right)^{\frac{k-1}{k}} - 1 \right\}$$

This equation is to be found in many engineering handbooks; specifically, Marks "Mechanical Engineer's Handbook." From the data in the table the curves were plotted. It is interesting to note, in passing, how they reach out to a maximum and then recede.

Now, obviously, the figures in the table represent theoretical horsepower per cubic foot per minute of gas circulated. And we have the relation:

$$\text{T.H.P.} = P \times Q$$

By definition

$$E_V = \frac{Q}{D}$$

or

$$Q = D \times E_V$$

from which

$$\text{T.H.P.} = P \times Q = P \times D \times E_V$$

But also, by definition

$$E_{OA} = \frac{\text{T.H.P.}}{\text{B.H.P.}}$$

from which, substituting we have

$$\text{B.H.P.} = \frac{\text{T.H.P.}}{E_{OA}} = \frac{P \times D \times E_V}{E_{OA}}$$

Moreover,

$$E_{OA} = E_V \times E_C \times E_M$$

and therefore

$$\text{B.H.P.} = P \times D \times \frac{E_V}{E_V \times E_C \times E_M} = P \times \frac{D}{E_C E_M}$$

POWER REQUIREMENTS OF AMMONIA COMPRESSORS FOR VARIOUS PRESSURES

Head Pressure, Lb. per Sq. In. Ga.	Suction Pressure In Lb. per Sq. In. Gage											
	0	5	10	15	20	25	30	35	40	45	55	65
	Saturation Suction Temperature In Degrees Fahrenheit											
	−28	−17	−8	−1	5	11	17	21	26	30	37	44
	Horsepower per Cubic Foot per Minute of Gas Circulated											
120	.184	.207	.223	.233	.240	.244	.244	.242	.238	.233	.216	.194
130	.192	.216	.234	.247	.255	.260	.262	.262	.259	.255	.241	.222
140	.199	.225	.245	.259	.269	.276	.279	.281	.280	.277	.266	.249
150	.206	.234	.255	.271	.282	.290	.296	.298	.299	.297	.289	.274
160	.212	.242	.265	.282	.295	.305	.311	.315	.317	.316	.310	.299
170	.219	.250	.274	.293	.307	.318	.326	.331	.334	.335	.331	.322
180	.225	.258	.283	.303	.319	.331	.340	.347	.351	.353	.351	.344
190	.230	.265	.292	.313	.330	.344	.354	.361	.367	.370	.371	.365
200	.236	.272	.300	.323	.341	.356	.367	.376	.382	.386	.389	.386
210	.241	.279	.308	.332	.352	.367	.380	.390	.397	.402	.407	.406
220	.247	.285	.316	.341	.362	.378	.392	.403	.411	.418	.425	.425
230	.252	.291	.323	.350	.371	.389	.404	.416	.425	.432	.442	.444
240	.255	.297	.331	.358	.381	.400	.415	.428	.439	.447	.458	.462
250	.261	.303	.338	.366	.390	.410	.427	.440	.452	.461	.473	.479

It is the denominator of this expression that is here called *Compressor Efficiency*. Whether or not this is a term in common usage, it serves our present purpose. In other words, if the compressor efficiency be employed to increase or elevate the figures representing piston displacement, the result may be multiplied by the horsepower per C.F.M. of gas circulated, to secure the total brake horsepower required. This is the function of the diagonal lines connecting the two sides of the chart.

Symbols

C.F.M. = Cubic feet per minute.

B = Cylinder bore in inches.

S = Stroke in inches.

R.P.M. = Revolutions per minute (compressor speed).

C = Number of cylinders.

P = Horsepower per cubic foot per minute of gas circulated.

T.H.P. = Theoretical horsepower.

k = Ratio of specific heats for Ammonia gas = 1.29.

P_s = Suction pressure in pounds per square inch Absolute.

P_H = Head pressure in pounds per square inch Absolute.

Q = Cubic feet per minute of gas circulated.

D = Piston displacement in cubic feet per minute.

B.H.P. = Actual brake horsepower.

E_V = Volumetric efficiency.

E_C = Cylinder efficiency.

E_M = Mechanical efficiency.

E_{OA} = Over-all efficiency.

Duplicating Stratospheric Conditions for Airplane Testing

ONE of the outstanding laboratories in the country for testing airplane motors under stratospheric conditions is now being completed by the Army Air Corps at Wright Field, Dayton, Ohio. Here the York Ice Machinery Corporation has played a major part by designing and building the largest air cooling plant of its type in existence, to provide air testing temperature down to 67F below zero.

At 35,000 feet above sea level, air temperature is 67F below zero and atmospheric pressure is 4 lb. per sq. in. absolute, as compared to the 14.7 lb. to which we are accustomed. These, briefly, are the extreme conditions which Army engineers want in testing their aircraft engines in the new engine-testing laboratory.

Stratospheric low pressure conditions can be simulated by throttling the carburetor supply air to the engine, and exhausting the engine into a vacuum. The job is to cool the carburetor supply air down to a minimum of —67F and the gasoline supply to 0F.

The evaporators which reduce the gasoline temperature to 0F are three horizontal, shell and tube coolers, each capable of handling the full load alone, hooked up to an 8 in. x 8 in. ammonia compressor.

The cooling system for the carburetor supply air must be able to cool huge quantities of air to a minimum temperature of —67F, operating with any inlet air temperature from maximum down to —10F. Further, air quantities cooled may vary over a wide range.

Three separately-controlled cooling stages are used and a separate set of ammonia compressors operate on each of three separate evaporators, with all of the compressors discharging into a common condensing system.

The first step is to cool the air from 100F to 35F. This is done in a spiral-finned coil evaporator, containing water sprays, connected to an 11½ in. x 10 in. ammonia machine operating at 45 lb. suction pressure.

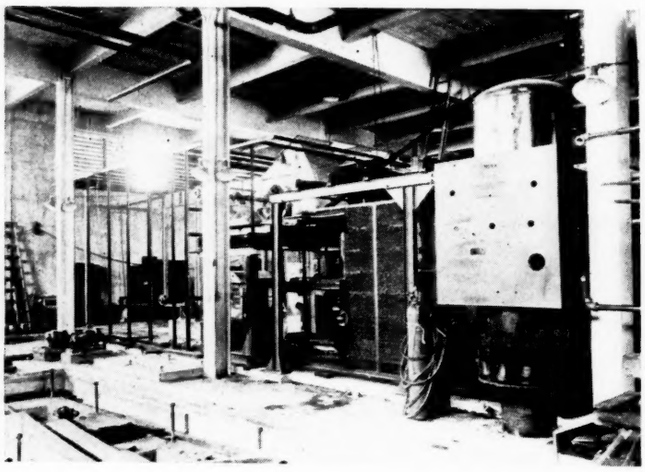
In the second stage the air is cooled from 35F to —13F. The evaporator is identical to that of the first stage except that a solution of ethylene glycol is sprayed over the coils instead of water. The ethylene glycol prevents frost accumulation to maintain high evaporator efficiency. This moisture picked up by the ethylene glycol, which would otherwise turn to frost, is boiled off in a concentrator before re-spraying. One 10 in. x 10 in. ammonia, four-cylinder compressor and one 11½ in. x 10 in., four-cylinder ammonia compressor supply refrigeration at 3 lb. suction pressure.

To cool the air down to —67F after leaving the second stage, 8 nests of trombone coils are arranged in an air tunnel, to provide progressive cooling at —77F evaporator temperature. One 10 in. x 7½ in. 2-cylinder and two 15 in. x 10 in. 4-cylinder ammonia booster compressors draw the ammonia vapor from the trombone coils and discharge it at higher pressure through intercooling equipment into the second-stage suction lines.

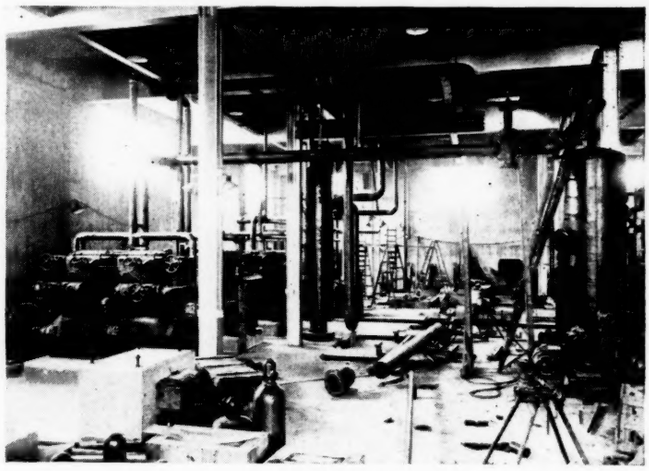
The entire casing surrounding the three air stages is air-tight and thoroughly insulated with cork. A fan located between the second and third stages pulls air through the first two stages and pushes it through the third, so that air is delivered at the end of the third stage at —67F and atmospheric pressure. At this point secondary fans pick up the air and distribute it through heavily insulated ductwork to the separate airplane engine testing rooms, one or all of which may be in use at any given time.

The third wind tunnel is divided into two sections so that hot gas may be used to defrost one-half of the tunnel while the other is still operating. No defrosting is necessary in the first and second stages.

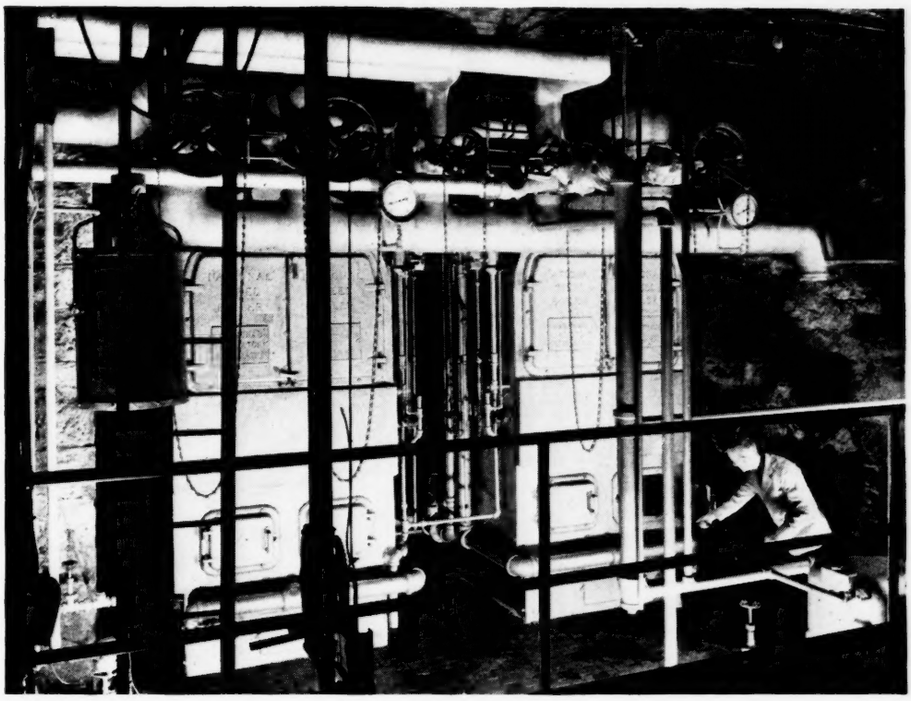
The common condensing system consists of two horizontal shell and tube condensers, into which all the ammonia compressors discharge (the boosters indirectly through the second-stage compressors). After condensing, the liquid ammonia goes directly to each of the three evaporators, passing through an intercooler in stage three.



Construction view of the three air-cooling stage compartments at the Wright Field engine testing laboratory, Dayton. On the left is the frame work of the first and second air-cooling stages. Fans are visible in the center. On the right is the low-pressure ammonia receiver for the third-stage and, behind it, one end of the third-stage wind tunnel.



Construction view of the refrigerating room in the testing laboratory. In the left foreground are the booster compressors for the third-stage of air cooling; behind them the second and first-stage ammonia compressors, respectively. In the center is the intercooler apparatus; on the right, the suction trap for stage three can be seen.



National steel boilers with special extended water legs for stoker firing. Stokers are installed from rear. Front of boilers is clear for cleaning fire. Branch mains from headers provided with chain wheel valves. Note vacuum return pump, ash hoist and automatic sump pump for floor drain below sewer level.

Pittsburgh's Motor Square Garden Modernized with Steam Unit Heaters

IN every large metropolitan city there is at least one building which can be considered a landmark that has stood for decades, which everyone in the city has visited at one time or another, and which everybody knows about. In New York, Madison Square Garden is such a place; in Pittsburgh, one such structure is Motor Square Garden, because in this building, automobile shows have been held annually since the beginning of motor cars; food shows, political mass meetings, equipment displays, rodeos, dog shows, boxing and wrestling bouts, and almost every conceivable type of exhibition has shown here since the building was completed in 1896. When this structure was erected, it was built by expert craftsmen using only the finest of materials with the result that it is still in perfect condition, a massive monument to careful craftsmanship.

Recently, a Pittsburgh automobile executive, E. H. Newmeyer, secretary-treasurer of the Eierman Cadillac-LaSalle Company, was delegated the responsibility of converting the old Motor Square Garden into a modern automobile sales and super service setup—a prodigious remodeling and alteration task. His objective was that when completed the building would be the finest automobile setup in the United States.

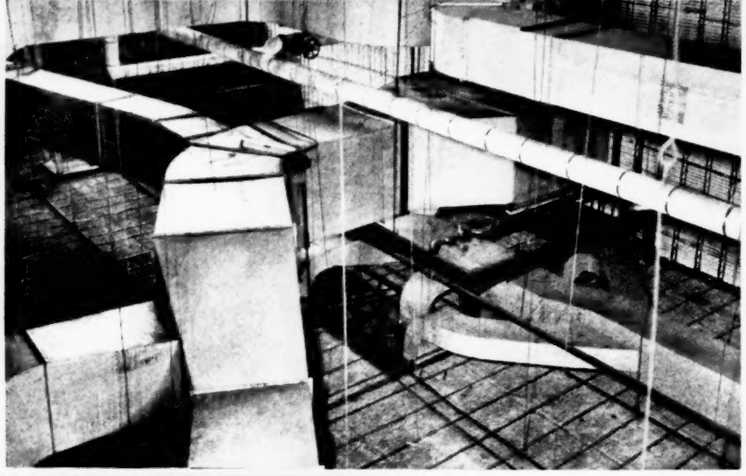
Mr. Newmeyer's objectives are today a reality, but before this dream became a material actuality, many hardships were encountered, many disappointments were met, and many problems had to be solved. Among these problems were the huge facia (275 ft. long) stainless steel Carrara glass sign above the front and side windows; the showroom lighting to bring out all colors at night with daylight effect and, most difficult of all, the heating and ventilating problem. But like all the other problems that arose, the proper solution was found only after careful study. Today, Motor Square Garden enjoys a most modern heating system and, as Mr. Newmeyer puts it: "For this, the orchids go to E. N. Hunting of Hunting, Davis & Dunnells, designing engineers, and to W. C. Niebaum of Geo. B. Stewart Company, contracting engineers, both of Pittsburgh."

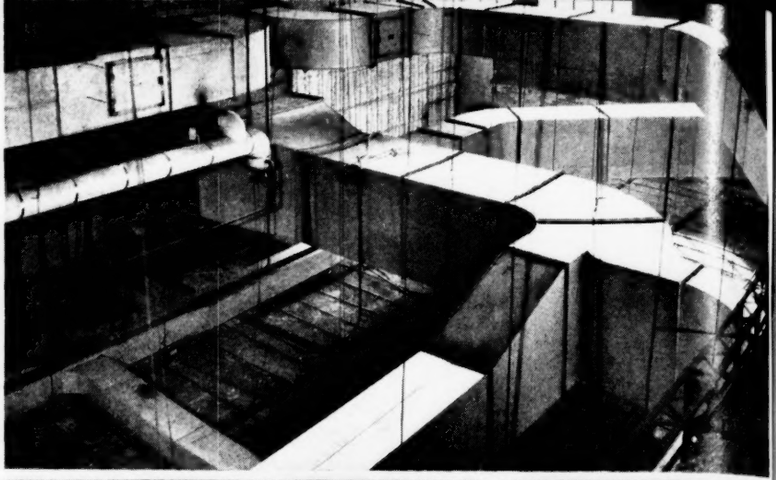
Heating System

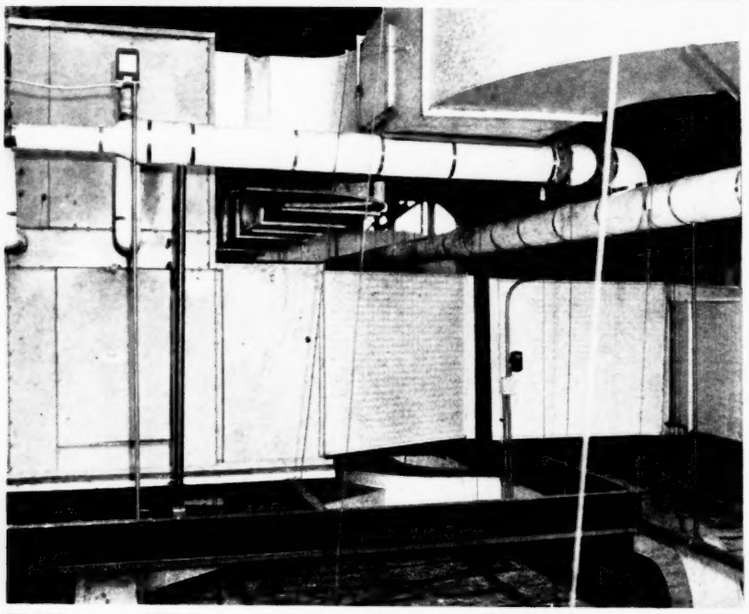
The heating system is low pressure steam with the return lines under vacuum with the piping designed for a total pressure drop of ½ lb.

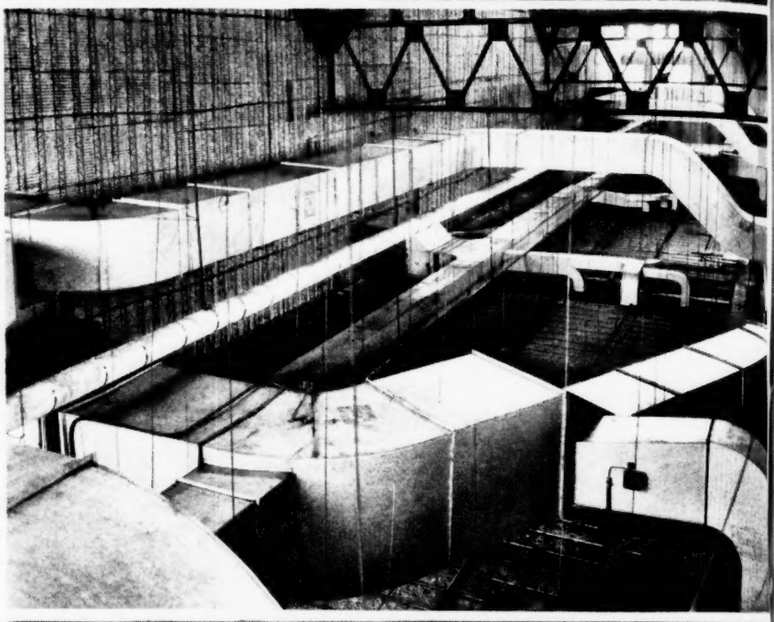
Separate feed mains are used for show room, inside office, service department and basement. Valves with chain wheels for easy operation are installed on each of these mains at boiler. Mains were installed in basement so that no horizontal piping would be exposed in the service department. All piping for first floor units is concealed, except the risers at columns for unit heaters in the service department.

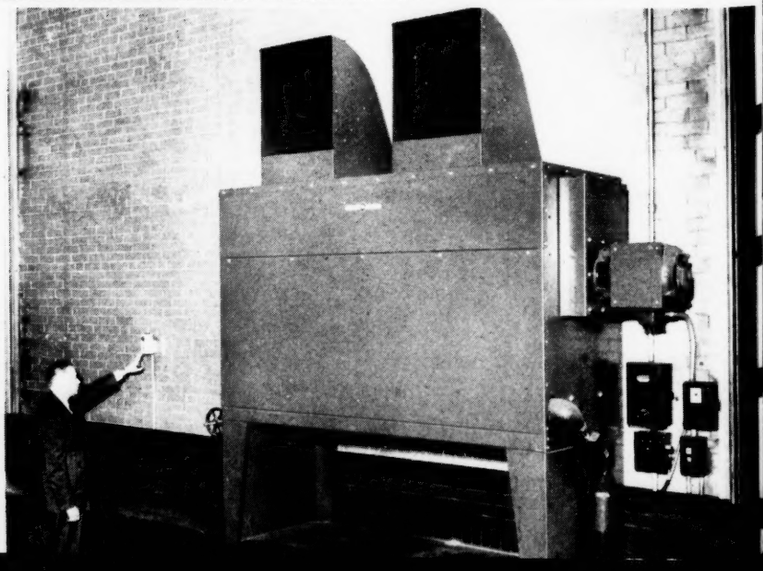
Each unit heater is supplied with a union bonnet gate











Left Column—

(Top) Westinghouse air conditioning units placed above suspended ceiling of inside offices are used for heating the Show Room.

(Upper Center) Graduated motorized steam valves operated by thermostat in return air duct, control steam supply to heating coils to maintain desired temperatures.

(Lower Center) Discharge grilles on inside walls of Show Room near ceiling are connected to duct system above suspended ceiling of inside offices shown. Return air grilles can be seen near floor.

(Bottom) One of the Herman Nelson suspended heating units in basement showing ducts and discharge nozzles. These units are thermostatically controlled.

Right Column—

(Top) Air conditioning units with supply and return ducts. Fresh air is on right of return duct, and is controlled by motorized dampers so that temperature of air entering unit is not below 60F. Fire dampers and flow control dampers are located in feed ducts at access doors.

(Upper Center) General view of supply and return duct work used for heating the Show Room. This equipment is located above suspended ceiling of offices. Exhaust system for inside offices is just above suspended ceiling.

(Lower Center) This large Show Room 160 ft. long by 54 ft. deep, has practically all glass exposure on three sides with all windows to the floor. Conditioned air discharged from grilles on the inside wall blankets these windows and heats the Show Room evenly and comfortably.

(Bottom) These floor type Herman Nelson heating units are installed in Service Department at large outside doors. Units are installed on existing bulkheads to conserve floor space and are automatically controlled.

valve on both feed and return connection. Condensation from the units and from drips is handled by Warren Webster thermostatic float traps. The condensate is returned to a Nash automatic vacuum and condensate pump and receiver where it is discharged to boilers. A vacuum of 5½ in. is maintained in the return lines.

Radiators of Shaw Perkins design are installed in the offices to offset the heat loss from the cold ceilings, outside walls and service department walls. The parts department is heated with a suspended unit heater automatically controlled.

The service department is heated by ten Herman Nelson suspended type and two floor type unit heaters, each having a capacity of 228,000 B.t.u. and 585,000 B.t.u. respectively. The floor type units are located at the large entrance doors. The suspended type units, located in the balance of the department so as to give an even distribution of heat, are each controlled by a separate thermostat located in the zone heated by the unit. A limit thermostat attached to the return piping prevents operation of the unit when there is no steam to the unit. An even temperature of 60F is maintained in the entire service department.

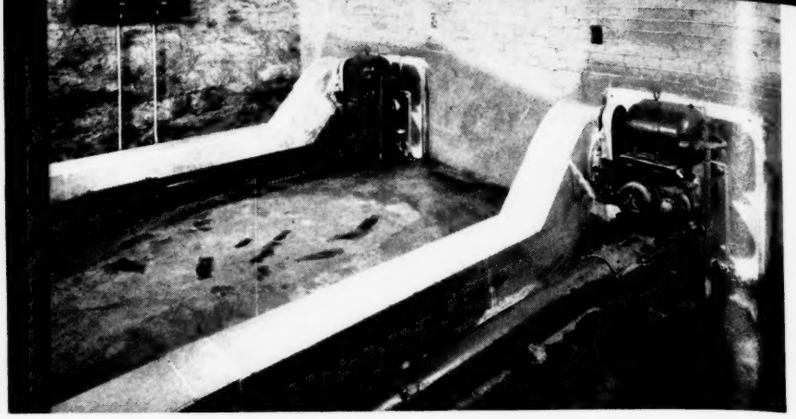
This department has exceptionally high ceilings, large glass area from windows, monitors, and dome, and big roof and exposed wall surfaces which make it difficult to heat. The distribution of the units and the individual control have resulted in highly satisfactory heating conditions, with uniform temperatures at all areas.

The basement has three Herman Nelson heating units suspended from ceiling, each having a capacity of 300,000 B.t.u. Supply ducts connected to these units run on the ceiling across the basement with discharge nozzles at various points for proper air distribution. There are no return ducts. Each unit is turned on and off by the demands of its thermostat. A limit thermostat prevents operation when there is no steam at the unit. There is also a master thermostat which will not permit the basement units to operate unless the service department is 58F or more. This is to cut down the boiler load for quick pick up in the mornings when the fire has been banked all night.

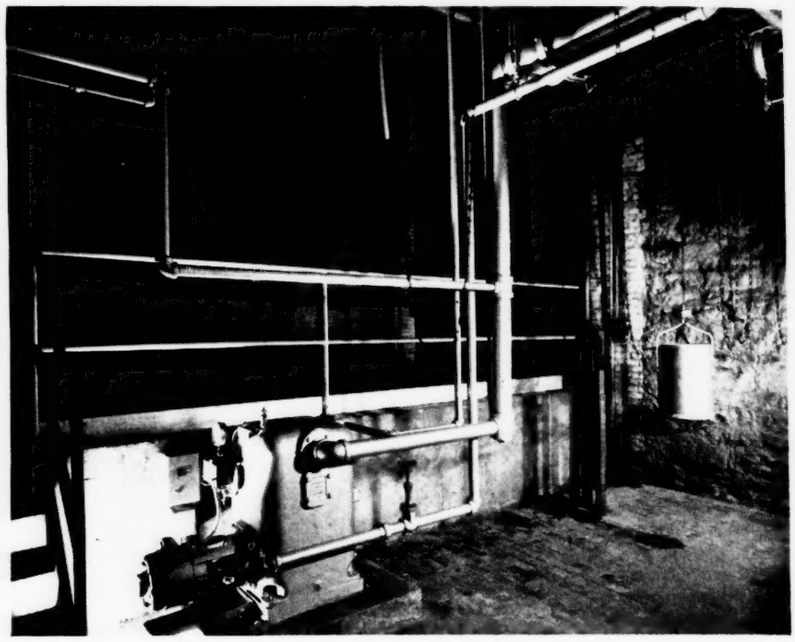
Boiler Room

The boiler room and coal bin are under the street and coal is delivered direct to the bin by dump trucks

A view of the old Motor Square Garden as modernized for the Eierman Cadillac-LaSalle Company.

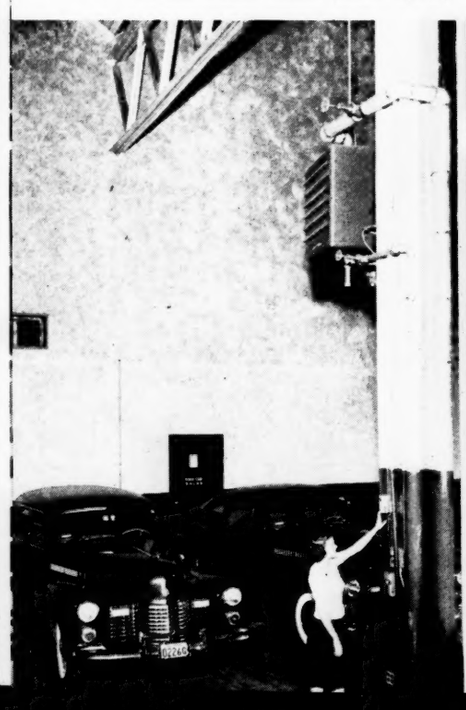


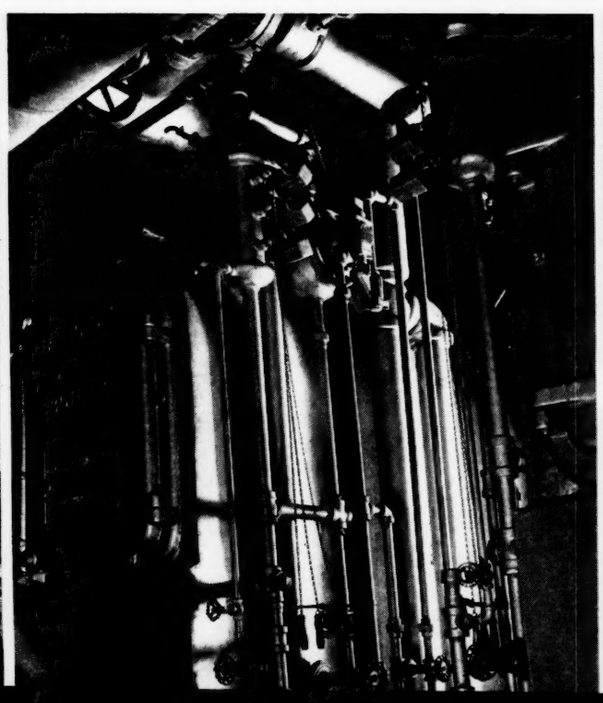
(Left) Shaw-Perkins radiators in the inside offices are used to offset the heat loss from cold walls and ceilings. (Right) Gear case, motor, worm housing, fan housing and air ducts on Auburn push model bin feed stokers.

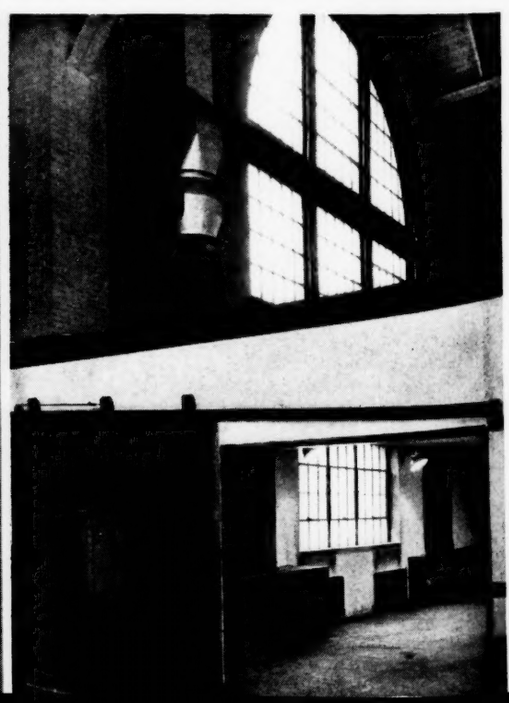


(Left) View taken from the Northeast corner of Service Department showing Duco spray room in extreme left background and Parts Department in center foreground. Eight Herman Nelson heating units can be seen from this view. (Right) Nash automatic vacuum and condensation return pump with cast iron receiver. Ash hoist to sidewalk above.

(Left) Discharge grille from exhauster for front offices, and typical Herman Nelson unit heater installation in Service Department. Units are automatically controlled by White-Rodgers thermostats for temperature and reverse action aquastats which stop the fan when there is no steam in the line. Condensation from unit heaters is handled through Warren Webster & Co. thermostatic float traps. Note metal guards for protection of pipe covering near floor. (Center) Hartford equalizing loop, automatic water feed and low water cut off with bypass, hand feed, water column and surface blow off installed on boilers. (Right) Paint Spray Booth is ventilated by a DeBothezat Type L 24 in. fan in a Bifurcator Housing so that the motor is out of the air stream. The motor is a 1 hp. 220-volt, 60-cycle, 3-phase, 1150 r.p.m., ball bearing. This unit has a capacity of 6680 c.f.m. against ¼ in. S.P. The total cubic feet of air in the room is 14,000. Complete air change every 2¼ minutes. The main exhaust duct is 24 in. square. The duct to each of the grilles is 18 x 20 in. The grilles are 4 ft. long and 1 ft. wide, placed 6 in. off the floor. The reason they are placed so close to the floor is that, according to the Pennsylvania State Code, paint spray fumes are heavier than air and tend to fall and for that reason the air is taken from the floor.







through manholes in the street. It was necessary to pit the boiler room and coal bin to secure sufficient ceiling heights for the boilers and piping. This brought the boiler room floor below the sewer level and a Chicago sump pump was installed to drain the boiler room. The boiler room floor has a concrete slab finished with vitrified paving brick. Clinkers are removed from boiler room to sidewalk by a G & G electric ash hoist.

Two National Radiator Co. steel boilers having special long extended water legs for stoker firing furnish the heat required for the building. Installed under these boilers are Auburn worm type underfeed push model bin feed type stokers. These stokers have three speed and neutral gear drive, the feed and fan being driven by 3 hp. motors. The maximum coal feed is 600 lb. per hour for each stoker. The stokers are installed at the rear of the boilers which leaves the front of the boilers free for cleaning. No handling of coal is required by the attendant.

With the special long water leg on the boilers, the stokers are installed without any brick work above the retort, with the exception of the bridgewall. The bridgewall is laid with fire brick having aluminum content, since clinkers do not fuse as readily to this type of fire brick.

Controls on boiler and stoker consist of automatic water feed, low water cut off and pressure control. Pressure is maintained from 3 lb. to 6 lb. at the boiler. Valved surface blow offs are installed on each boiler.

The boilers are insulated with two courses of 1 in. thick magnesia blocks with ½ in. magnesia cement trowelled on. All steam feed piping is insulated with air-cell covering pasted and banded; sizes 3 in. and smaller is 1 in. thick and larger sizes 1½ in. thick. In the service department return risers are insulated to a height of 8 ft. from floor and protected with heavy metal sleeves 30 in. high. Feed riser insulation is also protected in this manner.

Air Conditioning Units

The show room has large glass windows extending down to the floor so that there is practically all glass surface on three sides of the room.

Over the suspended ceiling of the inside offices are installed two Westinghouse air conditioning units for heating the show room. These units, equipped with heating coils and filters, are so arranged that cooling coils can be added later if desired. Each unit has a capacity of 8500 c.f.m. and a heating coil of 500,000 B.t.u. at 60F entering air.

From these units supply and return ducts are run to outlet grilles in show room. Supply grilles have directional air flow fins which blanket the large show windows with warm air and counteract the heat loss at its source. Return grilles are located near the floor in the inside partition. Fresh air is taken from the outside through louvered and screened ducts and connected to the return air duct system.

Each unit has a thermostat located in the return air duct controlling the two modulating motor operated steam supply valves on the heating coil which close on rising temperature.

Steam valves are in parallel and set so that one valve closes at 1½ to 2F lower temperature than the other valve. A limit thermostat located at the fan inlet controls motor-operated outdoor and return air dampers to maintain temperature of return air at 60F or higher. The outdoor air damper is interlocked with the fan motor so that the outdoor air damper will close when the fan is not running.

The room is evenly heated without drafts or cold spots.

Ventilation

The inside offices which are in between the show room and the service department are ventilated through a fan exhaust duct system, having a capacity of 6000 c.f.m., which discharges its air into the service department, helping to heat that area. The air exhausted from these rooms is replaced by conditioned air from the show room. Exhaust systems are located in men's and women's locker, toilet and shower rooms to ventilate these quarters. American Blower fans are connected to ducts to the outside of the building.

The paint spray booth, shown in an accompanying illustration, has a cubage of 14,000. The ventilation is designed to give a complete air change every 2¼ min. and to accomplish this a DeBothezat 24-in. Bifurcator fan is used to keep the motor out of the air stream. This fan has a capacity of 6680 c.f.m. against ¼ in. static pressure. Air is discharged through 1 ft. x 4 ft. grilles placed 6 in. off the floor, inasmuch as the paint-laden air is heavier than atmospheric air. The two grilles are served by an 18 in. x 20 in. duct which is joined to a 24 in. square duct in which the Bifurcator is placed.

The results with the heating and ventilating system in Motor Square Garden indicate that this installation has been one of the outstanding modernizing jobs of this year.

Floor Temperatures for Radiant Heating

In the section on Radiant Heating published in last month's HEATING AND VENTILATING as Reference Section No. 1, Chart 2 entitled "Floor Temperatures for Radiant Heating," and appearing on page 38, contained an error on the horizontal scale at the lower left of the chart reading "Floor Temperature, F." Reading from left to right the scale as it appeared read 65, 70, 75, 85, 90, 95; it should have read 65, 70, 75, 80, 85, 90.

Sun Shading Devices for Windows to Reduce Air Conditioning Load

IN many summer air conditioning installations the heat gain from solar radiation is an important part of the load. This heat gain takes place through the roof, through the walls, and through the windows and doors. The heat gain through windows is, due to its magnitude, of considerable concern to the engineer, who needs reasonably accurate data so that he can estimate both the design load, on which the size of the conditioning system is based, and the power consumption over a period. For the former the engineer needs maximum figures; for the latter, average data.

The total maximum air conditioning load is a synthesis of many types of load, including the human load, that from appliances, conduction, and so on, as well as solar radiation. This being the case, the maximum total load may occur at widely differing times of day, depending on such things as type and occupancy characteristics of the building. The quantity of solar energy received, too, is dependent on the time of day, as well as on latitude, season, and orientation, so that all in all the problem becomes fairly complex.

Heat enters a building through windows in three different ways: first, by conduction due to the temperature differential between the air inside and that outside, just as it leaves the building in winter; the quantity can be calculated just as simply. Second, by infiltration of warm air or exfiltration of cold air; and third, by radiation from the sun. It is with this third component that this article is concerned, independent of the other two.

The radiant energy which impinges on a window depends on the angle at which the sun's rays strike the window. These angles have been calculated for different seasons, different latitudes, and for variously oriented walls, so that the resulting heat impinging can easily be determined for any given window on a square foot per hour basis.

Not all of this energy enters the room, though. A small percentage of it is absorbed by the window glass which is not entirely transparent to the sun's rays. Multiplying the quantity of impinging energy by the proportion transmitted will result in a figure for that entering the glass by radiant means. These data are shown in the left hand portion of Table 2. Heat absorbing glass will transmit much less radiant "heat" than common glass, and figures applying to this type of glass have previously been presented on these pages in a form identical to Table 2.*

With the exception of heat-absorbing glass, all other means of reducing solar heat gain are methods of shading the window. These include the well known awning for the outside of the window, roller shades and venetian blinds for the inside and, more recently introduced, a shading screen. All of these have been tested for shading ability, both alone and in combination.

Most important of these tests have been those under the direction of Dr. F. C. Houghten, at the ASHVE Research Laboratory, one group of these tests having been conducted in 1934 and a later group in 1940. The latter tests, dealing entirely with west wall conditions, were reported by Dr. Houghten at the 1941 annual meeting of the ASHVE, and his paper describes in detail the method of testing and the results. We are here concerned only with his results, and those in a broad way.†

While at first thought the testing of such devices seems simple, actually it becomes complicated; the resulting data are, moreover, difficult to interpret because of the variables. For example, in tests on venetian blinds the shading effect depends to a very large extent on the angle of the slats. If they are closed much of the light, as well as much of the heat, is excluded; on the other hand, considering a west wall, if the slats are at a small angle to the horizontal, mid-afternoon will see the sun's rays pouring directly into the room. Obviously, the maximum benefit in shading will be obtained by manually adjusting the shade at frequent intervals.

All of Houghten's 1940 tests were on west walls. His findings were tabulated by hours, concluding at 7 p.m. The results are, in some ways, somewhat confusing, particularly since the time lag caused heat absorption in the test houses even after sunset.

Some criticism of the tests has been made because of the fact that they were not run during periods of high temperatures approaching design conditions. On the other hand, if the data are considered relative to those for a bare window, it would seem that the results should be reasonably accurate in a comparative sense.

Pending further and more conclusive tests, the following analysis of Dr. Houghten's data summarizes some of the points brought to light. In all cases, figures given here apply to the data on the west wall from 1 to 6 p.m. only.‡

Roller Shades: An ordinary dark green roller shade tested in a half drawn position, gave fairly consistent results from 1 to 6 p.m. in that it transmitted during each of these hours about 94% of that through a bare window.

Obviously the percentage transmitted by shades

*See HEATING AND VENTILATING, December, 1939, page 35. However, recent tests indicate that the figures given in that table are conservative, and that the heat absorbing glass may possibly reduce the heat gain by about 32% over plain glass, instead of 23% as shown in that article.

†It should be emphasized that since these tests dealt primarily with west walls the conclusions necessarily apply to west walls. It may be (and the data in Table 2 tend to corroborate this) that the relative merits of the different shading devices might vary from wall to wall, depending on orientation.

‡The tests, in most cases, lasted until 7 p.m. The 6 to 7 readings have not been included in this discussion, purely as a matter of judgment, due to the high quantities during that hour which seem difficult to explain. Averages including the 6-7 period are given in a footnote to Table 1.

TABLE 1.—SOLAR HEAT GAINS THROUGH WINDOWS

(In Per Cent of That Through Bare Unshaded Single Windows. Figures Are in Excess of Air-to-Air Conduction)

Bare Window	100%
Green Roller Shade*	94
Double Glazed Window, plain glass	92
Aluminum Venetian Blinds	74
Heat Absorbing Glass, single	68
Buff Roller Shade, half-drawn	68
Double Glazed Window, one plain glass and one heat-absorbing glass	62
Venetian Blinds, 45°, drawn*	58
Aluminum and Buff Roller Shade	45
Outside Venetian Blind*	39
Shading Screen (Koolshade)*	30
Canvas Awning*	29

*Figures given based on tests covering the period from 1 to 6 p.m., west wall. For the complete period tested (1 to 7 p.m.) the averages are as follows: green roller shade, 95.1%; inside venetian blinds, 60.6%; outside venetian blinds, 35.3%; shading screen, 30.6%; canvas awning, 33.8%.

would be reduced with the shades full drawn; it is just as obvious, though, that this would considerably reduce the light transmission at the same time.

In the 1934 tests by Houghten a buff-colored shade was tested. The results with this were rather surprisingly low in comparison to the green shade, the percentage of heat transmitted by the buff shade, half drawn, being 68%.

Venetian Blinds: These are of two types, for inside and outside application. Tests included both, as well as different finishes.

The results from an inside blind with aluminum finish and consequent relatively high reflecting ability and with slats at 45° indicated a heat transmission of 74%, as averaged over the 1 to 6 p.m. period. The range covered varied from 62.5% at 1 to 2 p.m., increasing to 80.6% at 5 to 6 p.m. No information is available as to the proportion of light excluded at 45°; it is probably fairly high, particularly with the wide slats used in this type of blind.

In the 1934 tests an average figure lower than those above was obtained—58% for drawn blinds with slats at 45°. This figure, as with others from the 1934 tests, was an average for different rooms and not for the west wall only.

Better results in excluding heat are obtainable with the outside venetian blind. From 1 to 6 on the west wall the average, in per cent of bare window, was 38.5%, ranging from 44.3% (1 to 2), as low as 37.2% (2 to 3) to 34.9% (5 to 6). An aluminum outside venetian blind tested in 1934, with aluminum slats, gave a transmission of 22%. However, the slats were "adjusted during the day to admit a maximum of light without any direct sunshine getting through the sides."

Double Glazed Windows: Tests in 1940 included those on double glazed windows of ordinary glass. These showed a fairly constant heat transmission ranging from 91 to 93% of a bare window and averaging about 91.6%. In addition, double glazing of a single thickness of ordinary glass and another thickness of heat absorbing glass was experimented with. These results, too, were constant, ranging from 60 to 63% and averaging 62.4%.

Awnings: Very good results have been obtained by the use of canvas awnings. An average figure for an ordinary canvas awning in the 1934 tests was 28%, while in the 1940 series a dark outside awning gave a figure of 31% with the figures ranging from 24.7 (4 to 5) to 27.6% (5 to 6).

Shading Screen: Since the 1934 tests an entirely new method of shading windows has been introduced and tests on this were included in the 1940 series.* This device, due to its construction, serves the dual purpose of screening against insects as well as shading.

In the west wall tests the percentages for this screen range from 21.6% of a bare window from 1 to 2 to 42.4% during the period from 5 to 6 p.m. The average for the afternoon from 1 to 6 was 29.7%. This device has some advantages as compared with other methods of shading which enter into a selection of shading devices. The spacing and angle are such that only approximately 24% of the horizontal light rays are directly cut off. In the case of the ordinary venetian blind at 45° angle practically all horizontal direct rays are cut off. No information is available as to the exact percentage of light admitted by the different methods but the shading screen probably is superior in this respect.

Comment on Table 1

The first half of Table 1 gives data for shading devices which have a relatively high solar heat transmission—that is, they are in the upper third bracket. The latter half of the table is devoted to devices whose heat transmitting ability is less than two-thirds of that of bare glass.

Some comments can be made on this table as follows: First, it will be noted that inside venetian blinds fall in both the high and the low categories. They are in the low category when drawn and with slats at 45°. In order to obtain the lower figure mechanical adjustment is necessary and this is also true of the aluminum and buff roller shade tested in the 1934 experiments.

Generally speaking, the available evidence summarized in Table 1 shows that the really effective barriers to solar heat are of three different types: (a) the outside venetian blind, (b) the shading screen and (c) canvas awnings. Since the percentage transmitted by these three types of devices is 39, 30 and 29‡, respectively, the differences among the three are not sharp insofar as straight heat transmitting ability is concerned.

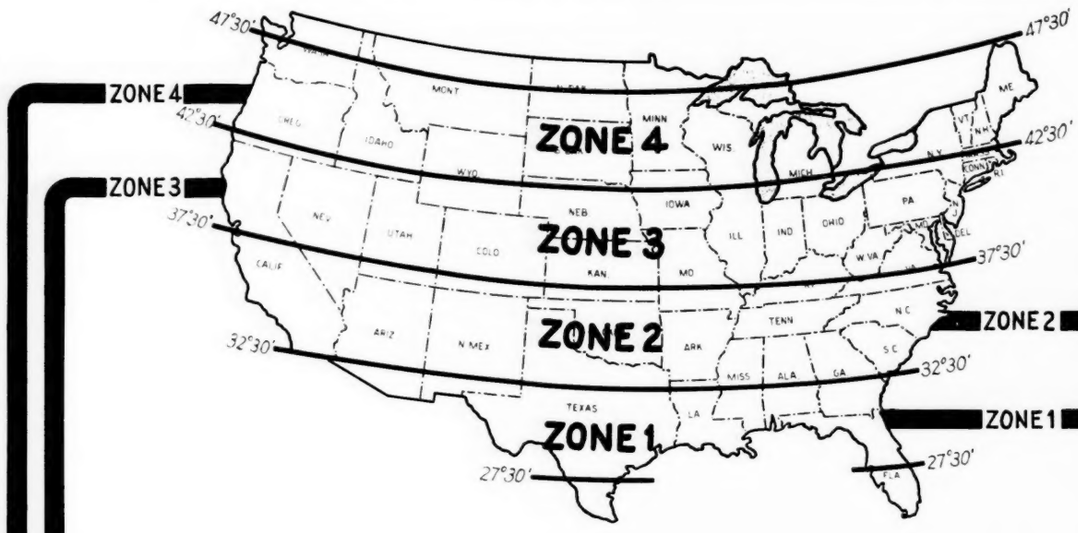
A selection among the three may, then, depend on the hour of peak load. Table 3 summarizes the hour-by-hour ratio of solar heat entering through each of the three on a west wall and indicates that in the early afternoon with near vertical rays, the screening shade is nearly twice as effective as the awning or blind. By mid-afternoon the awning and screening shade are equal and both more effective than the blind. In late afternoon, however, the awning is superior, followed by

*This device consists of a screen similar to a venetian blind but with extremely small slats which are not adjustable. The slats are only 0.05 in. wide and are spaced at 0.06 in. apart and held at an angle of 17° with the horizontal. It is sold under the trade name Koolshade, and is intended for outside use.

‡For the period (averaged) from 1 to 6. For the 1 to 7 p.m. period the averages are 35, 31, and 34, respectively.

TABLE 2—SUN HEAT TRANSMISSION OF BARE SINGLE WINDOWS VS. SINGLE WINDOWS WITH SHADING SCREEN

(Figures apply to midsummer conditions and do not include air-to-air transmission by conduction)



PLAIN GLASS

BTU TRANSMITTED INTO ROOM PER SQ FT OF GLASS PER HOUR

TIME OF DAY	ORDINARY VERTICAL GLASS WINDOWS FACING E	SE	S	SW	W	NW	N	NE	HORIZONTAL SKYLIGHTS
6 AM	104	43					23	96	8
7	167	86					14	149	56
8	185	110						135	123
9	160	110						95	182
10	107	90	9					42	234
11	39	52	17						260
NOON		10	21	10					272
1 PM			16	51	39				256
2			8	87	104	40			228
3				106	154	91			175
4				107	178	130			119
5				86	167	150			56
6				43	104	96			8
6 AM	104	39					20	95	10
7	167	84					9	134	59
8	185	117						125	125
9	160	124	8					81	181
10	107	114	20						230
11	39	83	38						255
NOON		38	44	23					267
1 PM			38	68	39				251
2			22	103	104	26			221
3			7	120	155	78			174
4				116	178	120			118
5				91	167	134			59
6				45	104	95			10
6 AM	104	34					18	93	14
7	167	82					5	130	62
8	185	123						115	125
9	160	138	17					68	178
10	107	137	44					15	224
11	39	114	62						248
NOON		74	71	39					260
1 PM			61	88	39				244
2			42	119	104	14			216
3			18	131	155	65			172
4				125	178	110			118
5				97	167	130	5		62
6				47	104	93	18		14
6 AM	104	29					16	92	18
7	167	80						124	63
8	185	128	5					106	123
9	160	150	32					54	173
10	107	160	66					6	218
11	39	139	89	9					239
NOON		108	98	57					250
1 PM		9	87	105	39				235
2			64	135	104	6			210
3			31	145	155	52			166
4			5	135	178	100			117
5				102	167	124			63
6				48	104	92	16		16

SHADING SCREEN

BTU TRANSMITTED INTO ROOM PER SQ FT OF GLASS PER HOUR

TIME OF DAY	HEAT ABSORBING VERTICAL GLASS WINDOWS FACING E	SE	S	SW	W	NW	N	NE	HORIZONTAL SKYLIGHTS
6 AM	27	9					6	24	–
7	57	17					4	42	–
8	42	16						21	–
9	21	12						10	–
10	12	9	1					4	–
11	4	4	2					1	–
NOON		1	2	1					–
1 PM			2	4	4	1			–
2			1	9	12	4			–
3				12	21	10			–
4				16	42	21			–
5				17	57	42			–
6				9	27	24			–
6 AM	36	12					5	33	–
7	59	20					2	41	–
8	42	18						20	–
9	21	14	1					10	–
10	12	11	2					3	–
11	4	6	3						–
NOON		2	4	2					–
1 PM			3	6	4				–
2			2	11	12	3			–
3			1	14	21	10			–
4				18	42	20			–
5				20	59	41			–
6				12	36	33			–
6 AM	39	13					5	33	–
7	61	22					1	39	–
8	43	21						17	–
9	22	17	2					8	–
10	12	13	4					2	–
11	4	9	6						–
NOON		4	6	4					–
1 PM			6	9	4				–
2			4	13	12	2			–
3			2	17	22	8			–
4				21	43	17			–
5				22	61	39			–
6				13	39	33			–
6 AM	46	16					4	39	–
7	64	25						37	–
8	45	25	1					16	–
9	23	20	4					7	–
10	12	16	7					1	–
11	4	11	9						–
NOON		5	9	5					–
1 PM			9	11	4				–
2			7	16	12	1			–
3			4	20	23	7			–
4			1	25	45	16			–
5				25	64	37			–
6				16	46	39			–

TABLE 3.—SOLAR HEAT TRANSMITTED THROUGH THREE SHADING DEVICES BY HOURS, WEST WALL
(In Per Cent of That Through Bare Unshaded Single Windows)

Time, p.m.	Outside Venetian Blind	Canvas Awning	Shading Screen
1 — 2	44%	40%	22%
2 — 3	37	27	22
3 — 4	39	27	27
4 — 5	37	25	36
5 — 6	35	28	42

the blind. If the peak load from other sources should occur prior to late afternoon the shading screen seems superior. If the peak is at late afternoon, the awning seems to have the edge.

In cases where the peak hour is not a consideration, the problem becomes a matter of judgment, price, opinion, taste, appearance, fire hazard, maintenance, winter storage, strictly local considerations, or other factors. The shading screen, being an insect screen, offers this as an advantage, with the additional feature of requiring no adjustments at the beginning or end or during the day.

As mentioned before, data have previously been presented on heat absorbing glass. Table 2 is here presented to show the B.t.u. transmitted by radiation through each square foot of glass per hour for different oriented windows. This is given in the left hand portion of the table and, compared with it, similar corresponding data are presented on the right hand portion of the table for the shading screen, this portion of the table being based on figures from tests made by the manufacturer.

Industrial Drying

Drying has become a science and is now a specialized branch of engineering; industry cannot afford to install dryers haphazardly designed, as was done so often, not many years back, because the cost of drying definitely affects the selling price, according to A. W. Ferre, B. F. Sturtevant Co. Industrial Drying Dept., speaking before the Massachusetts chapter of the ASHVE recently. Abstracts from Mr. Ferre's talk follow:

Air in itself does no drying. It is just a convenient vehicle for conveying heat to the material to be dried, and as a means of conveying moisture from the article that is being dried. There is one other advantage of using air, and this is the ease with which its temperature and humidity can be very accurately maintained.

If we remember that atmospheric air, when saturated with water vapor is nothing more than saturated steam at very low pressures, then we can realize that we may have air and water vapor as superheated steam, but at atmospheric pressures. If the vapor pressure in the air about the material equals the vapor pressure in the material itself, then a state of equilibrium will exist and no vaporization will take place.

However, if the vapor pressure in the mixture is below that which is required for saturation at a given temperature, vaporization will take place until such time as equilibrium is established. In order that this point shall not be reached and that the material shall continue to give off its moisture, it is necessary to break down the vapor pressures. This can be accomplished by continually raising the temperature of the surrounding air, so that equilibrium is never reached, or by reducing the temperature, so that the vapor is precipitated out of the material, then carried off; and the remaining mixture again reheated so that the material will give off moisture again until equilibrium is reached.

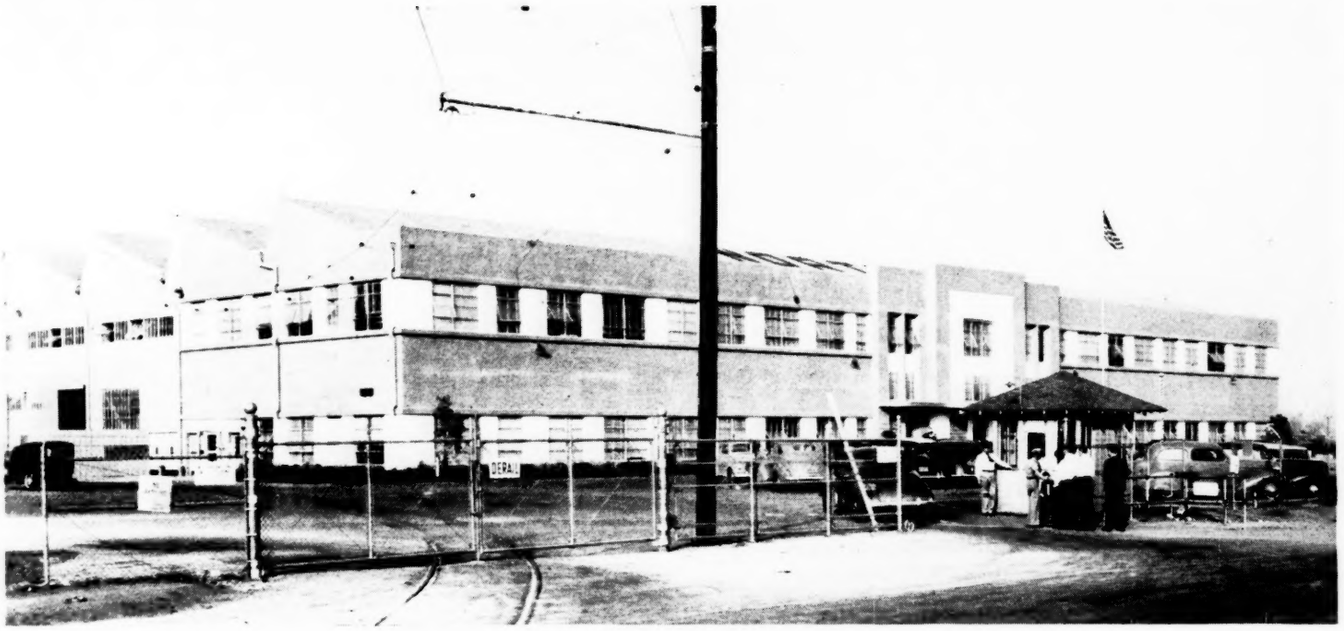
Still another method is to remove a given quantity of the surrounding medium as it approaches equilibrium and introduce to the mixture an equal quantity of air whose vapor content is very low. Thus the thermal process of a dryer design is capable of theoretical analysis.

However, physical properties and characteristics of the material to be dried are not so easily determined and must be studied experimentally. Water that is part of or mixed with a material is usually very complex in its form and the position and form of this water greatly affects the rate of drying or evaporation. Moisture on the surface is very readily evaporated, but the interior moisture must be diffused to the surface of the material before evaporation can take place. The rate of this coming to the surface depends greatly upon the characteristics of the material and in most cases is the factor which controls the rate of drying.

One thing that tends to retard the rate of drying when a material is heated by air is the thin, stagnant film of air which forms about the surface of the material and is in intimate contact with the surface, and which is more thoroughly saturated than the rest of the drying medium, thus tending to retard diffusion of moisture to the surface of the material.

To insure rapid drying, this film must be removed from the surface of the material as rapidly as possible, in order that diffusion of moisture to the surface be rapid. It then follows that the velocity and direction of air across the surface of the material has a very important part in the rate of drying. It can be assumed that with the increase of temperature and air velocity, the rate of drying will increase until the limit of the drying speed of the material itself has been reached. This can only be determined experimentally and this speed limit cannot be exceeded without damage to the material or to the structure of the material.

Of course it is necessary before any drying is attempted that we should know the exact amount of moisture that is to be removed. As the bone dry weight of an article is always constant, it is well to base the percentage of moisture in a product on its bone dry weight. The drying engineer should also always remember that it is always cheaper to remove water mechanically than by evaporation or drying and all excess moisture should be removed by some mechanical means.



Exterior of Northrop Aircraft's Hawthorne, California factory.

NORTHROP AIRCRAFT, INC.,

adopts forced hot water system for addition to its Hawthorne plant. Heat generated in two gas-fired low pressure steam boilers, heat distributed to plant by unit heaters.

INSTALLATION of a forced circulation hot water heating system in the factory of Northrop Aircraft, Inc., Hawthorne, Calif., represents a change in the attitude of Southern California airplane manufacturers on the heating of manufacturing plants. Prior to the installation of the hot water system in the Northrop plant last year, most airplane factories in the Los Angeles metropolitan area, and virtually all industrial plants of other types (when any heating was used at all), used direct fired units of the fan type.

These heaters, at least in the opinion of some engineers, are somewhat of a fire hazard due to the open-flame construction of the heaters scattered about the factory. A large maintenance factor also was reported to be involved.

The operating saving achieved by Northrop Aircraft with its forced circulation hot water system, and the effective operation of the system during the past year have influenced the installation of similar systems by two other plane companies—Vega Airplane Co., Burbank, Calif., a subsidiary of Lockheed Aircraft Corp., and the Douglas Aircraft Co. addition at Santa Monica.

Northrop Aircraft Company pioneered the field in forced circulation hot water heating in Southern California industry, having been the first large factory in that area to be equipped with hot water heating throughout its manufacturing and office areas.

Two months after its organization early in 1939, Northrop Aircraft broke ground for construction of its own plant on a 75-acre site adjoining Hawthorne Airport, which has been renamed Northrop Field. Into that 250 by 500 foot building of 125,000 square feet of floor space the activities of the company were transferred in February, 1940.

Forced circulation hot water heating was introduced into the picture by English & Lauer, Inc., of Los Angeles. Northrop executives agreed to consider this type of system only if it could be installed for approximately the same price as a direct-fired heater system.

The hot water system was installed in the fall of 1939 and completed January, 1940, by A. B. Jones Co., heating contractors of Alhambra, Calif. Mr. Jones was assisted in the design of the system by Arthur Hess, engineer on the staff of English & Lauer.

The building is of one-story height with 35-foot ceilings. Its construction consists of a concrete slab poured on the ground, corrugated sheet metal sides, and a sawtooth roof. In order to keep down the cost of the system it was decided to use a one-pipe job with suspended projection type unit heaters. A circulation temperature of 240F was selected and the water quantity circulated was calculated to give a 40F temperature drop at the peak of the load.

The boiler plant in the original building consists of two Pacific gas-fired low-pressure steam boilers with a boiler rating of 13,000 square feet of radiation each. The boilers also supply steam to the metal treating tanks and the paint room.

A 300,000 square foot annex is in course of erection adjoining the original building. A second and larger

boiler plant is being installed in this annex. The new boiler plant, set up back-to-back with the older boiler room, from which it will be separated merely by a wall, will contain three boilers of the same type, but of larger size, those three having a total radiation capacity of 54,000 square feet.

In addition there is a sixth boiler (10,000 sq. ft. radiation) in the hammer house, a building which is used for pressing out wing sections by means of huge hydraulic pressure machines, and which is remote from the central heating plant.

The water is heated in steam operated hot water generators which are supplied with low-pressure steam from the boilers. This was done because there is a use for low-pressure process steam in the metal treating equipment.

Trane projection heating units with built-in fans are used as diffusers. Forty such units, suspended from the ceiling, heat the main factory.

The offices are served by a blast type heating and ventilating system using circulating hot water in finned coils which heat the air forced through them into the rooms by fans.

A large part of the original two-boiler plant supplies the paint room, which is equipped with a separate distribution system in the form of a fan-coil steam system. The separate system was necessary because fresh air is imperative in this department due to the effect of the paint booths in exhausting the air, which, after being used, cannot be recirculated. Heating is required in the paint room due to the fact that proper painting can only be accomplished above certain minimum temperatures.

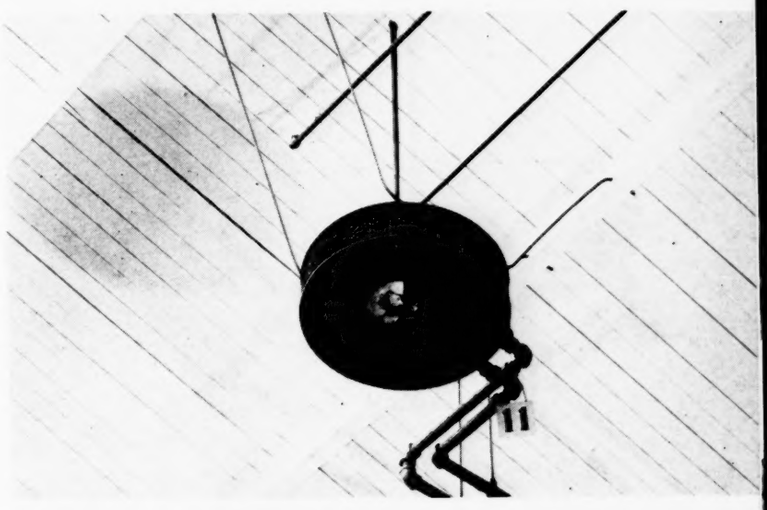
The paint department was 100 by 40 feet in dimension when the heating system was installed. It is being expanded three-fold to meet the expansion of the plant as a whole. This expansion has been concurrent with the company's increase in employees from 1000 to 2500 between September 1, 1940, and February 1, 1941, and the growth of its backlog of plane orders to $27,000,000 as of January 1.

The paint room at present is served by one 30,000 c.f.m. capacity fan unit. When the current enlargement program is completed the present paint room will be merged into one large department with another paint room now being constructed in the annex, in which a 60,000 c.f.m. fan unit is being installed. A third fan (30,000 c.f.m.) is to be added, supplying the combined paint rooms with a total of 120,000 c.f.m. of air delivery.

The factory is heated to 65F and the general offices to 72F. No attempt is made to maintain humidity, except at certain times in the paint room. Paint will not flow nor lend itself to proper spraying in temperatures lower than 80F. Should temperatures in this room drop below this, inspectors would order the department closed down until proper heating adjustment had been made.

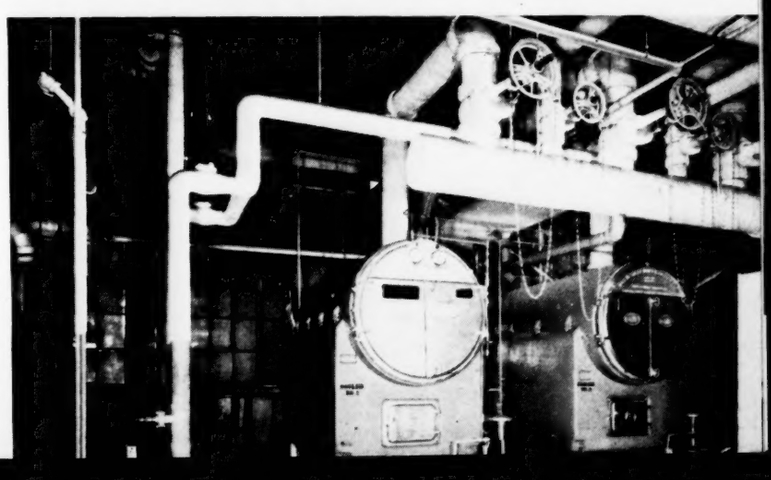
The only processing done in the plant is cadmium plating and anodic metal treating in the metal treating department in which small plane parts are either cadmium plated or, if aluminum, treated with chrome in anodic tanks. The heating plant supplies low-pressure process steam to the tanks, which are equipped with Minneapolis-Honeywell electric controls operating motorized valves. Washing and rinsing tanks are held to an average of 180F, anodic tanks at 80F, and magnesium treating tanks at 212F.

The results obtained from the metal tanks are considered one of the outstanding advantages of this type of heating plant, which provides the steam for operating the tanks. In addition to giving speedy and trouble-free operation, steam is credited with creating a flexibility of tank operation not obtainable with tanks which are subject to the definite limitation of electrical operation. A 10 kw. electric tank, for instance, has a range up to, but not beyond, 10 kw. The steam system employed in the Northrop plant, not being definitely limited, is claimed to be able to meet any over-demand within reason. This is regarded as notably advantageous because of the volume of parts handled.



(Above) Ceiling mounted Trane projection units of the type shown here heat the Northrop plant. There are 40 such heaters in the main factory.

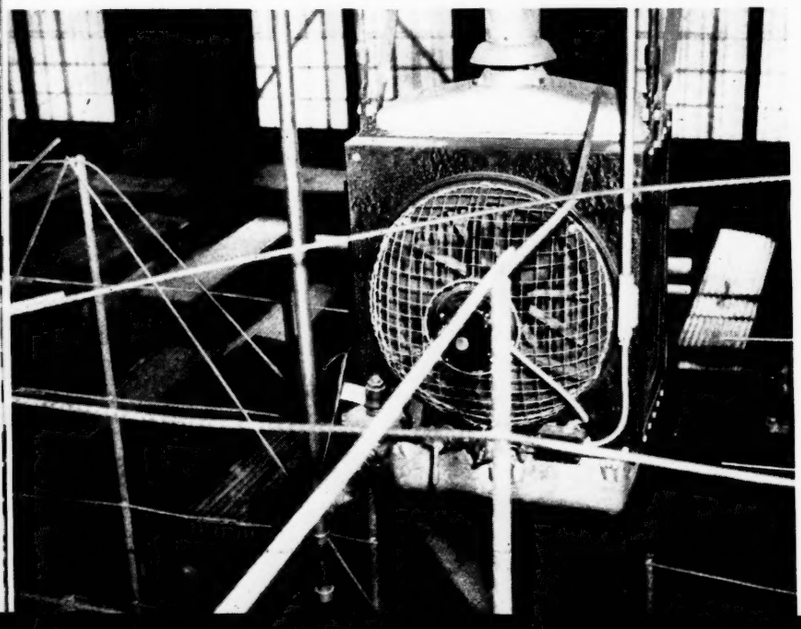
(Below) Boiler plant consists of two Pacific 13 000 sq. ft. gas-fired boilers which supply steam to hot water generators. A second boiler room is in course of construction in an annex beyond the glass wall.



PROFITS IN AIR

JONES & LAUGHLIN STEEL CORP.

eliminates sweating of metal sheets in its Louisiana warehouse by installing unit heaters to raise temperature, reduce relative humidity.



IN the New Orleans warehouse of Jones & Laughlin Steel Corporation where thousands of tons of metal are fabricated or warehoused annually, natural gas-fired unit heaters preclude the development both of red rust on the black iron and steel and white rust on the galvanized metal stored in a 90 x 75 x 23 ft. room built for the purpose three years ago. Here, five Buffalo Forge 100,000 B.t.u. per hour unit heaters automatically maintain 45% relative humidity. The room has hollow tile walls, an insulating wall-board ceiling, and includes a mezzanine about 15 feet deep on two sides. Sheet, plate, fencing, wire, corrugated sheet, gutters, ridgerows, baleties, wire rope, nuts, bolts, and other forms in black and galvanized iron are the principal materials stored.

Sweating of the metal is the danger, for much of it comes in packs, and moisture which can so easily be condensed between packed sheets and linger there, will quickly give rise to wide blemished areas of either zinc or iron corrosion products. The plant is located along the New Orleans Industrial Canal connecting the Mississippi River and Lake Pontchartrain down which come the tug-towed company barges carrying the metal shapes and forms to be stored for subsequent fabrication or shipment to wholesalers. A large tonnage of metal, chilled from the barge trip, is moved into the heat-conditioned storage room per day. Were the atmosphere therein unduly moist, the amount of disastrous "sweating" on the stock would not be hard to conceive.

According to A. D. McCutcheon, plant superintendent, "Only because this conditioned storage room is available can we handle such a wide stock. Here we handle nearly all items our Pittsburgh mills produce."

(Above) To prevent the corrosion of stored iron and galvanized stock at the New Orleans fabricating and warehouse plant of the Jones & Laughlin Steel Corporation, gas unit heaters controlled by humidistats preclude relative humidities in excess of 45%.

(At left) One of the five 100,000 B.t.u. per hr. Buffalo Forge gas fired unit heaters in the Jones & Laughlin warehouse.

PROFITS IN AIR

BIENVILLE WAREHOUSES CORP.'S

sugar warehouses in New Orleans are equipped with gas-fired unit heaters to supply heat so as to reduce relative humidity, thus eliminating trouble from caking.

IN two of the Bienville Warehouses Corporation's six warehouses along the Mississippi River docks in New Orleans, cane sugar, both domestic and Cuban, is stored in 100-pound bags or "pockets." Over 70,000 pockets may be warehoused on each of the two buildings' six sugar-storage floors (the top three in each structure). Rectangular piles of approximately 3000 bags each are laid on temporary frames of spaced wooden strips resting on 2-by-4's which lie, in turn, edgewise on the flooring—so that ventilation under each pile is possible. A clearance of at least 2 to 2½ feet is left between the top of each pile and the 10-foot ceiling for the same purpose. Aisles separate the endless piles covering the 300 by 103 foot space of each floor.

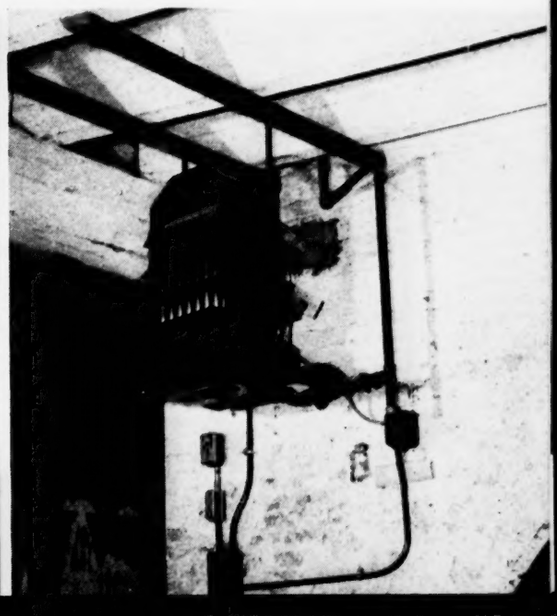
Moisture is the devil which C. H. Pott, general warehouse superintendent, worries about. Though it has little effect upon the saleability of rice, coffee, or tobacco, it can raise havoc with sugar—by caking it, lumping it, or hardening the whole bag, so that the granulated crystalline structure is destroyed, handling in user's plant is awkward, and the consumer must grind or crush before use. Temperature is incidental so long as it does not exceed 105 or 110F.

Accordingly, gas-fired unit heaters are installed, and so controlled by humidistats and temperature limiting controls that heat is automatically supplied on humid days as soon as the relative humidity tends to rise above 55%. Thus, although no moisture is removed from the room, the moisture concentration (as a proportion of that which the air will hold) is reduced, and the sugar remains indefinitely in first-class condition. The thermostat simply prohibits temperatures above 105 to 110F—and to date has not been called into action.

Circulation is provided both by the integral ½ hp. fans and louvres of the six-unit heaters plus the six additional Ilg fans completing the air conditioning system in each warehouse. On the second floor of each shed, each of the four corners is occupied by a Continental gas-fired unit heater (75,000 B.t.u. per hr. input) directed along one wall so as to establish circumferential circulation around the huge room. On the next (third) floor, the same arrangement is used except that (the heat input requirement being smaller by virtue of the heating on floor below it) two of the unit heaters are replaced by fans. And on the top floor, all heaters are dispensed with and replaced by fans so that circulation only is provided and all heat requirements are "borrowed" from the heated second and third floors.

Natural gas served at 6-inches water column pressure is reduced by a pressure regulator at each heater to a constant 4 inches; flues are of 4-inch galvanized pipe; heaters are hung 2 feet from the ceiling; and individual Minneapolis-Honeywell humidistats, thermostats and relays are provided for each unit heater.

(Left) Inspecting 100-pound pockets of Cuban cane sugar stacked at the Bienville Warehouses Corporation to prove the value of unit heaters as moisture-regulating air conditioners. (Right) One of the six 75,000 B.t.u. per hr. unit heaters controlled by humidistats to limit relative humidities in the Bienville Warehouses to 55% or less.



Economical Dust Control with Low Resistance Exhaust Systems

By F. F. KRAVATH†

PART 6 — PLENUM CHAMBER SYSTEMS

System Planning

IN hydraulic design, where velocities are invariably small as compared to pneumatic design, and the subsequent velocity head is insignificant and generally neglected, a piping layout such as illustrated in Fig. 11a could be expected to be workable without further balancing, especially if, as in this case, the branches were all of the same size. However, in air design, since velocities and their corresponding heads are considerably greater, such a design would be unworkable without balancing, or at least very uneconomical. For instance, in the case illustrated where hooded grinders are being exhausted through 4 in. diameter branches and it is desired to maintain an airflow of approximately 350 c.f.m. through each hood, it is obvious that due to the resistance drop between branch entries in the main duct, the machines furthest from the fan will handle less air. Thus "A" will handle the least air and "H" the most. If we limit "H" to 350 c.f.m. "A" will handle considerably less, whereas if we make "A" handle 350 c.f.m., "H" will exhaust a greater amount of air.

An expedient often used to make such a system workable is the installation of blast gates in each branch pipe. Thus, enough resistance is added to each branch (the closer to the fan, the greater the resistance added) to bring the branch static pressure at entry to the main up to the theoretic static pressure at the same point necessary to maintain flow in the desired volume through those branches at the greater distance from the fan. Branch "A" determines the resistance against which the whole system must work, for we must, manually, bring the remaining branch resistances up to match that of "A." While this is infinitely preferable to the expedient of merely boosting the fan speed so as to get 350 c.f.m. at "A" regardless of how much extra the remaining branches will handle, it is not the best way of handling this problem.

Fig. 11b illustrates a better layout of the same exhaust problem. Since "A" determines the resistance against which the system must operate, it is obvious that any reduction in the resistance encountered from "A" to the system outlet will show up as a saving in power. Thus, by using the most efficiently constructed bellmouth nozzle from hood to branch pipe, by increasing the pipe size from "A" to "B" from 4 to 4½ in. in diameter, and by reducing the pipe velocity in this branch from 4000 to 3800 ft. per min., the flow through "A" at 400 c.f.m. will balance the flow through "B" at 350 c.f.m. By adjusting blast gates in "C" and "D" so as to balance the flow through these branches at 350 c.f.m. and by duplicating this procedure in reverse for branches "E," "F," "G," and "H," then we are able to successfully join the two sub-mains into one main going to the cyclone and fan, as illustrated, and reduce the resistance worked against and the power required 15%.

It should always be endeavored to keep the resistance path of flow as short as possible. If in the system illustrated, branch "A" required 350 c.f.m. while the remaining branches required 1000 c.f.m. each or more, it is obvious that balance could not be obtained with the required branch volumes being secured through ducts all under a velocity of 4000 ft. per min., or some other common figure. Rather than make branch "A" determine the resistance for the whole system, it is far more economical to boost the volume of air being handled through this branch to a greater figure than required in an effort to reduce the resistance to flow. Since the formula for resistance to flow through circular piping reads

$$H = f \frac{2 L v^2}{g D}$$

where H = head loss, in feet of fluid,
f = friction factor dependent on piping material and construction,
L = duct length in feet,
v = feet per second, duct velocity,
g = acceleration of gravity, and
D = duct diameter, in feet.

It is plain that the resistance loss which varies directly as the friction factor, the duct length, as the square of the velocity, and inversely as the duct diameter, can only be decreased by increasing "D," for L and v are already at their lowest permissible values.

Plenum Chamber Systems

The plenum chamber system is a system with a large box or tank under pressure or suction and from which the various branch pipes emanate. In this type of system, there is no appreciable plenum velocity, and hence, the pressure or suction is practically constant at any point in the box. Naturally, such a system requires a minimum of balancing and is both simple and effective. Since there is no appreciable velocity within the box, it acts as a settling chamber and much material may be precipitated here, dependent on the size of the material and the velocity characteristics at vari-

†Office Engineering Division, The Panama Canal.

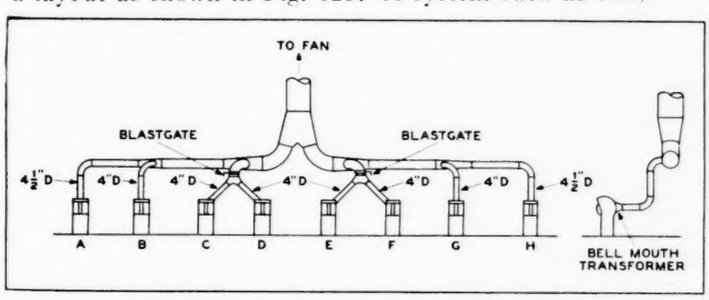
ous parts of the box. By locating the plenum chamber as close as possible to the various branches, the conveying velocity necessary within the branch pipes need be maintained for only a relatively short distance. Since the heavier entrained matter will be removed within the plenum, the exit velocity to the final filter, if necessary, or to the fan may be appreciably reduced. Both of these savings in resistance are worthwhile and may well save money in operation as well as increase the life of the system.

Referring to Fig. 12a, illustrated here is a plenum chamber located centrally with respect to the various branches. As can be seen, the branches are all short, almost all about the same length, and can be moved liberally without unbalancing the system or requiring any more work than the plugging of one hole and the cutting of another. The material collected within the plenum can be drawn off as required. The design as illustrated is extremely simple and economical to install, while the absence of mechanical elements within the box presages a freedom from maintenance worth considering.

Illustrated in Fig. 12b is another type of plenum chamber system. This type of system, while more elaborate than the preceding system, and hence, costlier to install, lends itself to a greater utilization of the advantages of the plenum idea. Being located beneath the level of the machines it serves, so low that the material trapped within the hood may slide by gravity down the branch into the plenum, it is unnecessary to maintain any more than the most meagre branch velocity. Actually, a branch velocity of 2000 ft. per min. has worked out very well inasmuch as this velocity has a velocity pressure of approximately ¼ in. water gauge, and yet is sufficiently great so that the branch pipe need not be overly large. Again, this type of system can be used to great advantage where the material entrained within the hood varies in size, being both fine and coarse. For instance, in one system of this type that the writer designed three quarters of the material eventually reclaimed (and the system included a cloth filter for final cleaning of the air) would have required a velocity of approximately 8000 ft. per min. to properly convey it. A system handling abrasive material with duct velocities as high as 8000 ft. per min. might well be worn out within two weeks. Again, the velocity pressure corresponding to this velocity is 4 in. water gauge. Contrast this figure with all its subsequent losses with what can be expected with a layout as shown in Fig. 12b. A system such as this, including a properly designed cloth filter can be designed, even in installations as large as 30,000 c.f.m., serving as many as 16 machines, and covering a workroom area of approximately 4000 sq. ft., to have an overall resistance loss of less than 3 in. water gauge.

While the extra cost of the drag conveyor, the elevator, and the storage tank will bring the total expenditure for a system of this type above that of the balanced proportioned main system, the savings in power to be realized in a large system over only a few years will not only wipe out this difference but wipe out a good portion of the capital investment. In a system like this, it is essential that the maximum velocity at any point within the plenum be no more than 1000 ft. per min. in order to insure good flow conditions at each branch. While the plenum is shown being exhausted at both ends (these pipes may join together), it is just as effective to draw from the middle of the box. Where only one pipe is used, exhaust should not be made at either end, since this will either mean an unduly large box for good performance, or a plenum velocity, which in many cases is high enough to introduce plenum resistance and subsequent unequal flow conditions at the branches. Exhausted in the middle or at both ends, exceptionally fine flow conditions prevail at the hood regardless of the location of the branch or the direction of flow within the plenum.

An extremely simple and effective form of the plenum chamber system is illustrated in Fig. 12c. Here, the grinders (application can be made to almost any type of machine) are built into the plenum chamber, or at least attached to it so that no contraction in cross-sectional area of the hood between the hood inlet and the plenum occurs. The bottom of the hood is so shaped that the material caught within the hood can slide, by gravity, down into the plenum, thus avoiding any conveying velocity. As has been pointed out in the body of this article, it is due to the various conversions of energy from static to velocity (or potential to kinetic) and back again, perhaps five or six times within any one system and the consequent inefficiency of conversion that so much resistance is encountered in an exhaust system above and beyond that due to pipe friction or filter loss. The type of filter illustrated eliminates the worst two of these conversions, besides reducing the overall pipe friction to a negligible point. This system also requires a drag or other type conveyor for removal of the precipitated material besides an elevator and storage tank for further handling. Naturally, if such a system can be laid out for a second or higher



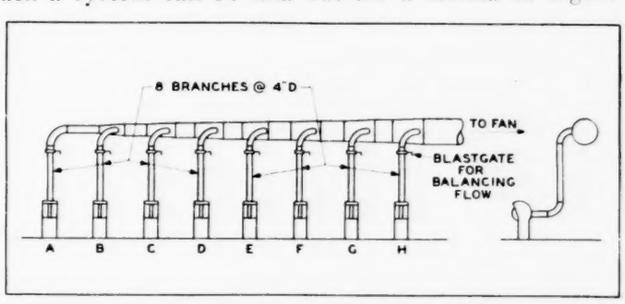


Fig. 11a (left). Typical exhaust piping design for row of grinders. Flow in this case has been balanced by the use of blastgates at 350 c.f.m. per branch. Fig. 11b (right). More economical design of exhaust for grinders based on lower resistance. Here, the manifold system is used to break up long runs the end branches being larger handle more air at a lower velocity and the bell mouth transformer from hood to branch is employed.

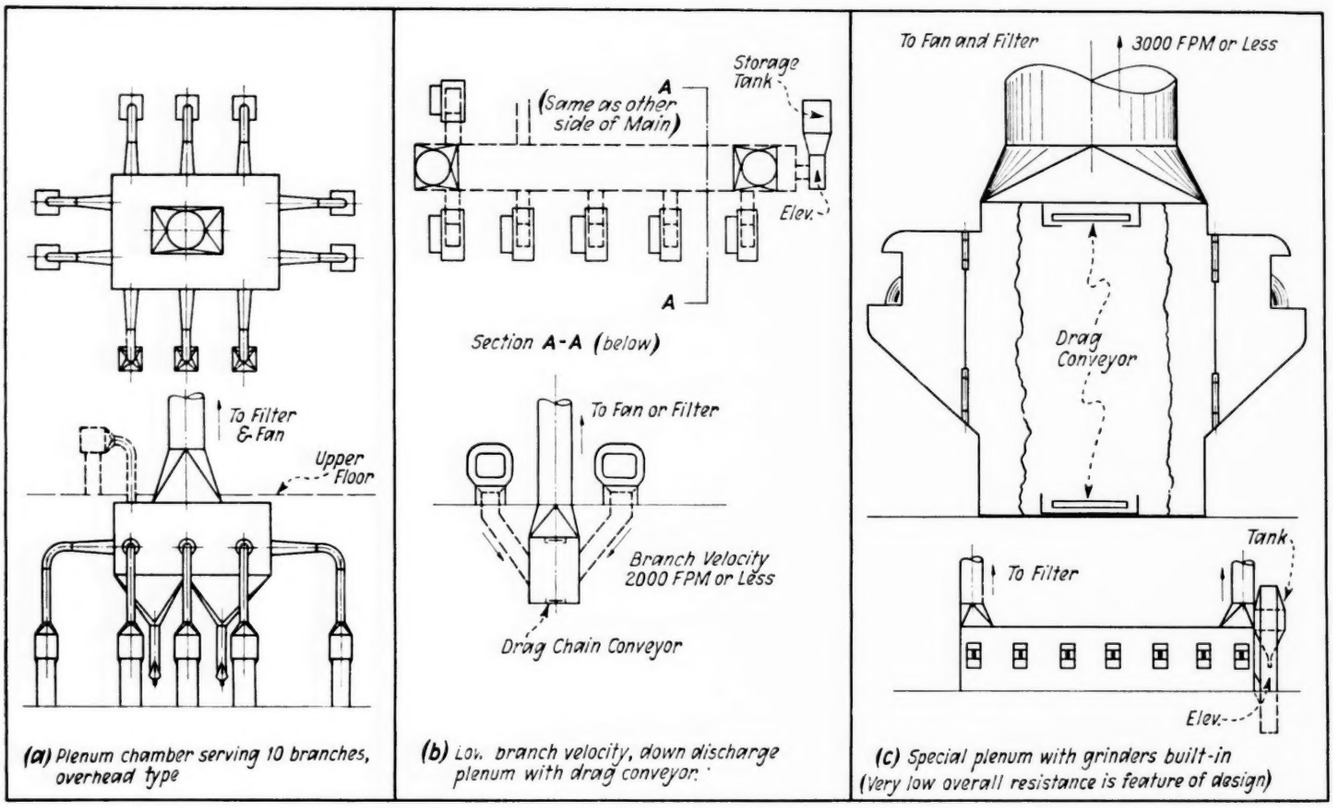

To Filter & Fan
Upper Floor
(a) Plenum chamber serving 10 branches, overhead type
Storage Tank
A
(Same as other side of Main)
Elev.
A
Section A-A (below)
To Fan or Filter
Branch Velocity 2000 FPM or Less
Drag Chain Conveyor
(b) Low branch velocity, down discharge plenum with drag conveyor
To Fan and Filter
3000 FPM or Less
Drag Conveyor
Tank
To Filter
Elev.
(c) Special plenum with grinders built-in (Very low overall resistance is feature of design)

Fig. 12. Various types of plenum chamber systems.

floor, then it is possible to remove this accumulated material through hoppers installed continuously from end to end, and from a lower floor. Another alternative is the use of the drag, screw, or belt conveyor and a chute to a lower floor for storage.

The actual arrangement of the mechanical equipment can be done in many ways, the determining factor being the building arrangement and the machine locations, as well as flow process. The type illustrated can be designed to have an overall resistance of less than 2 in. water gauge, including final filter, or, if the plenum is constructed with a large enough cross-section and the exhaust connection to the box is judiciously located, a tall tapering evase stack may replace the filter with a resultant overall loss of less than 1 in. water gauge. While this is not recommended for plants located in residential neighborhoods, it nevertheless has fascinating possibilities. Consider the savings possible if a system such as described replaced an ordinary none-too-well designed system with an overall loss of 10 or more inches. If the system were large, the saving in power might approximate 75 or more horsepower costing as much as $3000 yearly or even more.

Whether the material presented contains elements about which the reader is already aware, or information which is entirely new to him, it is nonetheless important that his mind be refreshed on the items mentioned. That it is costly to neglect them has already been shown. Any desire to transfer the burden of efficient design to sheet metal contractors will meet with failure unless performance guarantees are submitted by the various contractors bidding on the job, and the contractors know that they will be rigidly held to their guarantees. Then, if the contract is awarded on the basis of performance as well as price, there is an excellent chance of achieving good results.

There are only a few sheet metal contractors employing qualified dust control engineers, men who are able to design an efficient system. Yet, even these few if forced to bid competitively without specific performance guarantees, will resort to short cuts in order to save money for themselves—these short cuts almost invariably being at the expense of operating economy. Hence, the writer stresses again, in conclusion, the great benefits to be derived by a study of the science of dust control by the company's own engineers.

Cold Preserves Stored Nuts

Storage at 32 F in a relative humidity of 65 to 75% will keep in good condition for at least a year after harvest any of the nuts now important on the U. S. market—walnuts, pecans, almonds, filberts, and others —according to tests by the Bureau of Plant Industry of the Department of Agriculture.

In warm and moist storage, most nuts lose quality and crispness and eventually become rancid. Pecans are most difficult to keep fresh and flavorsome unless stored at 32 F, the bureau reports.

New National Gallery of Art in Washington Has 21-Zone Air Conditioning System

THE fifteen million-dollar National Gallery of Art, built with funds provided by the late Andrew W. Mellon, was dedicated by President Roosevelt on the evening of March 17. The building is situated between Constitution Avenue and the Mall.

Following Mr. Mellon's death the project was completed under the direction of Paul Mellon and David K. E. Bruce, trustees of the A. W. Mellon educational and charitable trust.

The architects were John Russell Pope and his associates Otto R. Eggers and Daniel Paul Higgins until August, 1937, when Mr. Pope died. Messrs. Eggers and Higgins continued the architectural services without interruption until the Gallery was completed, three years and three months after Mr. Mellon's death. The building is air conditioned according to plans prepared by Clyde R. Place, New York, who was mechanical engineer for the project.

The Gallery is notable in many respects. The masterpieces hung here include a hundred or more lofty examples of Dutch, British, Flemish, Italian, and Russian art presented by Mr. Mellon. Mr. Mellon's collection, according to his direction, will be only the nucleus of what the National Gallery will finally contain. The original gift included 111 paintings and 23 pieces of sculpture to which the Mellon Trust has since added 11 more paintings. In addition, the art collection of Samuel H. Kress was donated to the National Gallery in 1939. It consists of 375 paintings and 18 pieces of sculpture, all of Italian origin. The third great collection which has been promised to the Gallery is that of Joseph E. Widener.

The Gallery contains 179,000 sq. ft. of floor space on its main floor. The dominant entrance of the structure is on the Mall side up a flight of steps to a portico consisting of twenty marble columns, 6 ft. in diameter and 48 ft. high. The entrance to the main Gallery floor will be from this portico through 12-ton ornamental bronze doors electrically controlled. Immediately upon the main entrance to the lobby is the center rotunda, 103 ft. high with coffered dome ceiling and an oculus.

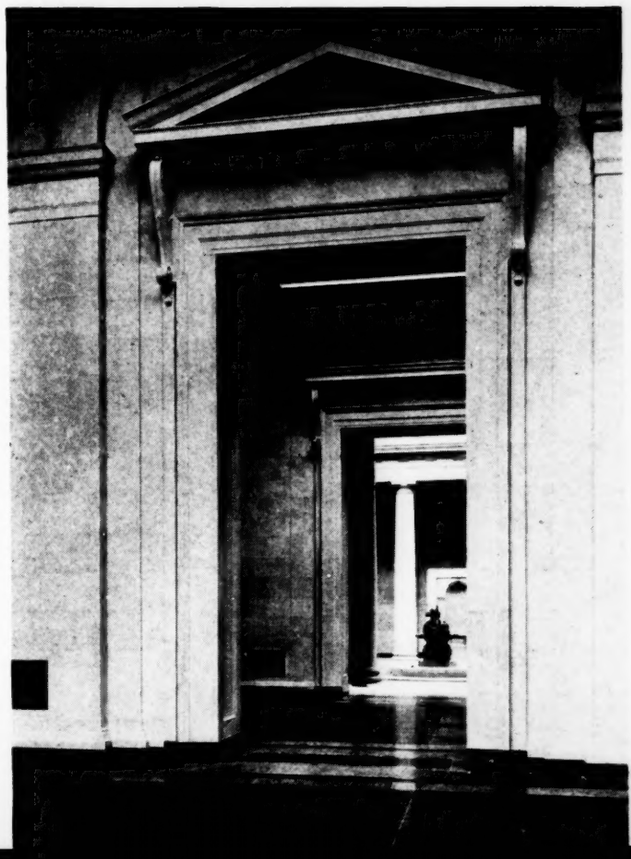
In accordance with the best judgment on gallery lighting, overhead day-light is used wherever possible. Although the Gallery shows not a window above the grade line, its roof is almost all glass. For the comfort of the visitors, and for the best possible preservation of the priceless paintings, the air is completely conditioned.

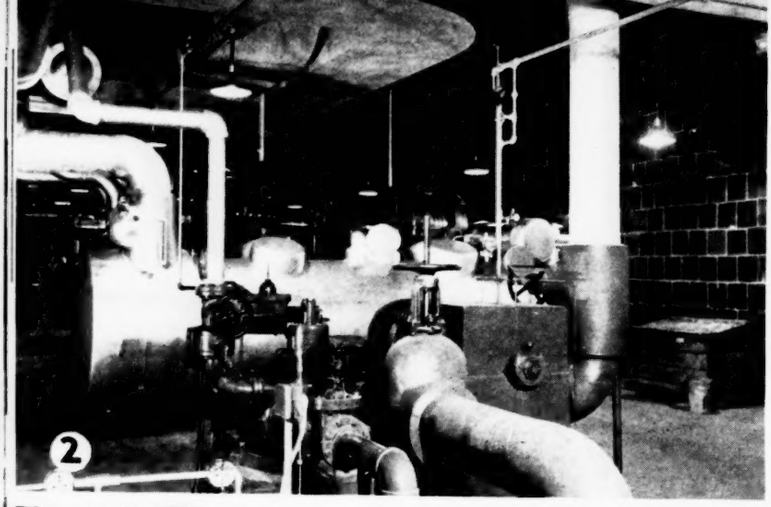
This feature was considered to be an absolute necessity in order to preserve the priceless art treasures to be stored and displayed in the building, as uniform humidities tend to prevent the expansion and contraction and subsequent deterioration caused by the wide differences of humidity that would otherwise occur. Therefore, while the comfort of the staff and visitors was considered in the design, the primary function of the air conditioning system is to maintain a constant humidity of 50% at all seasons of the year. Another precaution for the preservation of the contents of the building was the installation of air filters in all fresh and return air circuits of the air conditioning system so that all air delivered to the building would be thoroughly cleaned. The sulphur dioxide fumes in the air, injurious to paintings, are also removed by passing the air through a spray of chemically treated water. The temperature is maintained between 80F in summer and 70F in winter and automatically regulated in relation to the outside temperature.

The air conditioning system is divided into 21 units, each designed to take care of a certain section or zone of the building. Each unit consists, in general, of supply and return air fan, spray washer, pump, heaters, filters, and ductwork, and various control devices and maintenance instruments. The outside (fresh) air is brought into the building through intake ducts, some of which are large tunnels underground. The reason for these tunnels is that the fan rooms are in the interior and least desirable spaces.

The fresh air is carefully filtered, heated if desired, humidified or dehumidified, mixed with return air and delivered to the spaces at the proper temperature and relative humidity by the supply fan through ducts terminating in outlets fitted with grilles. Air is withdrawn from the rooms through a system of grilles and ducts by the return air fan and that portion to be re-used is returned to the apparatus, while the re-

1. A view along the long axis, from the east Central Gallery of the Garden Court and its fountain, National Gallery of Art.

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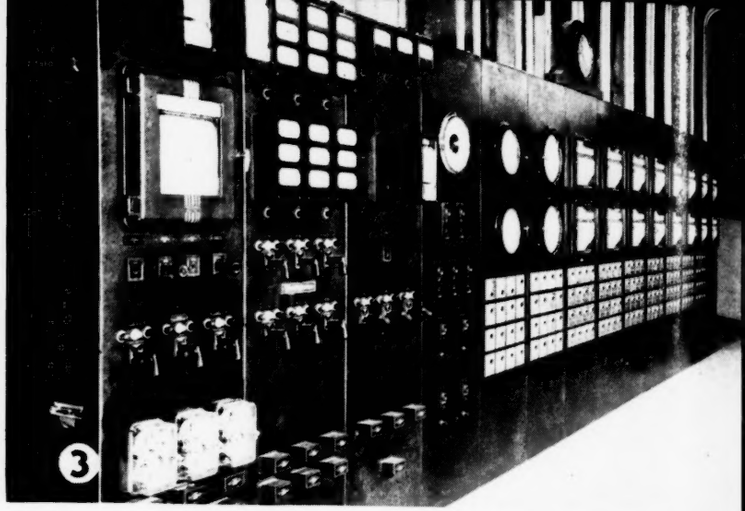
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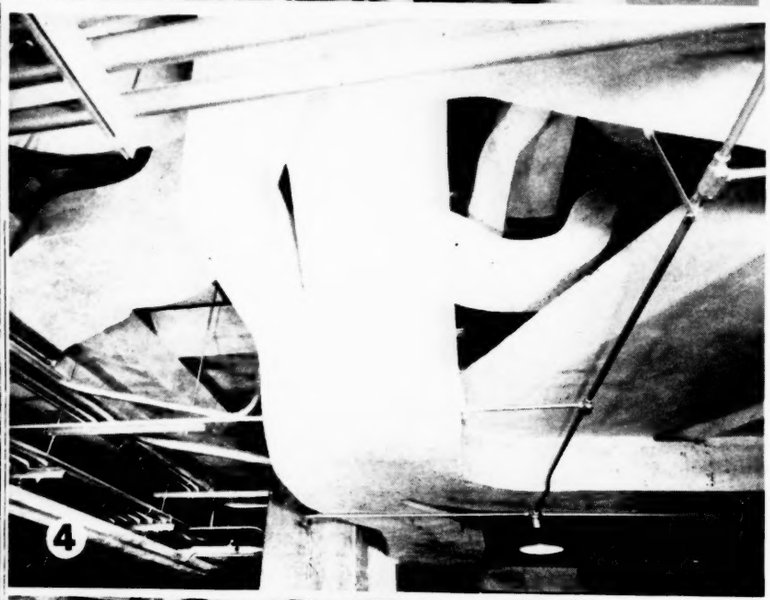
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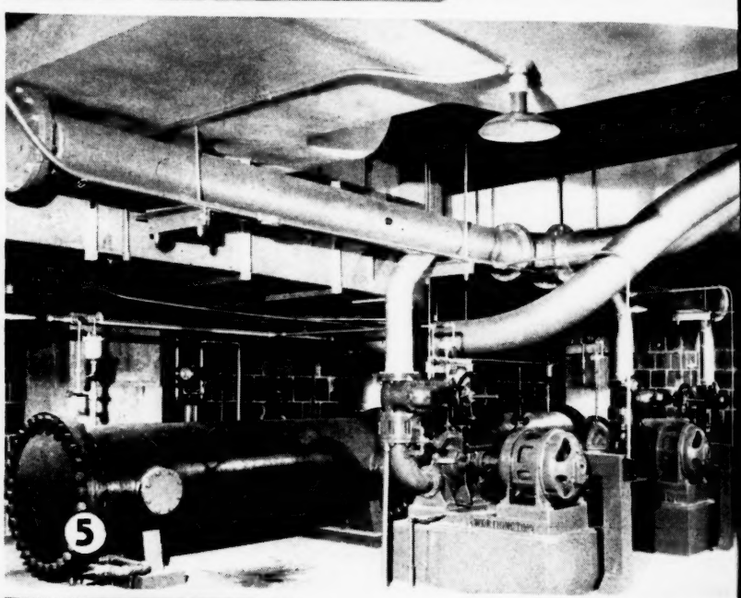
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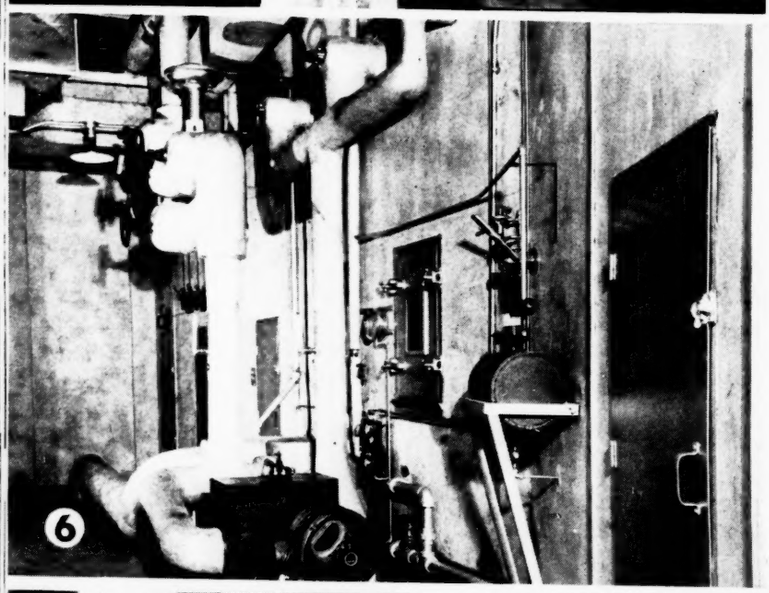
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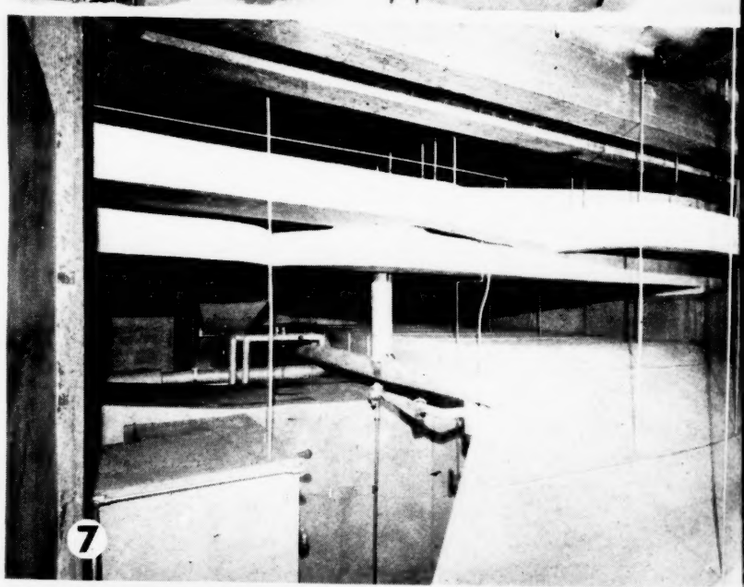
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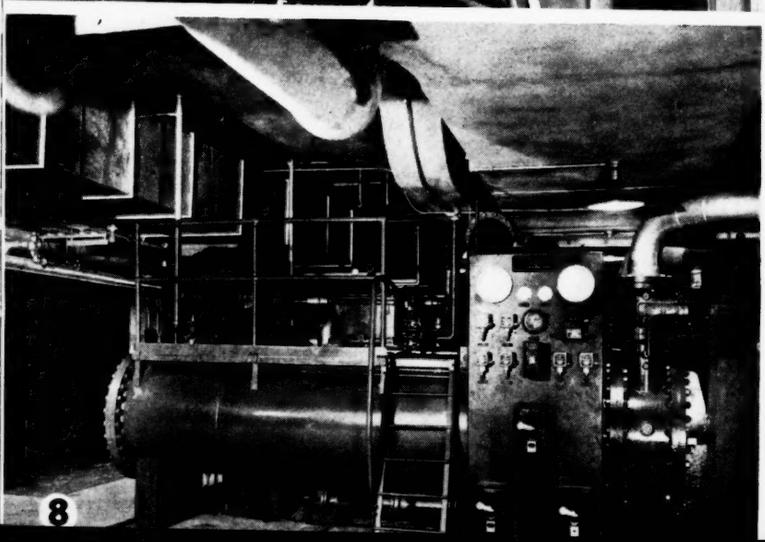
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9

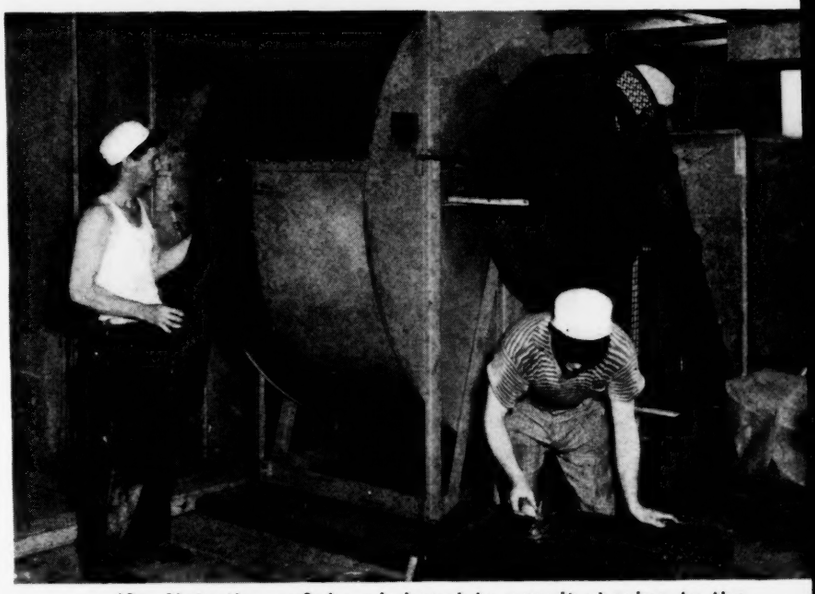
mainder is discharged to relief ducts which terminate outside the building.

In order to dissipate the heat removed from the conditioned spaces by cooling and dehumidifying, three centrifugal machines having a total capacity of 1040 tons of refrigeration are used to chill water for the washers.

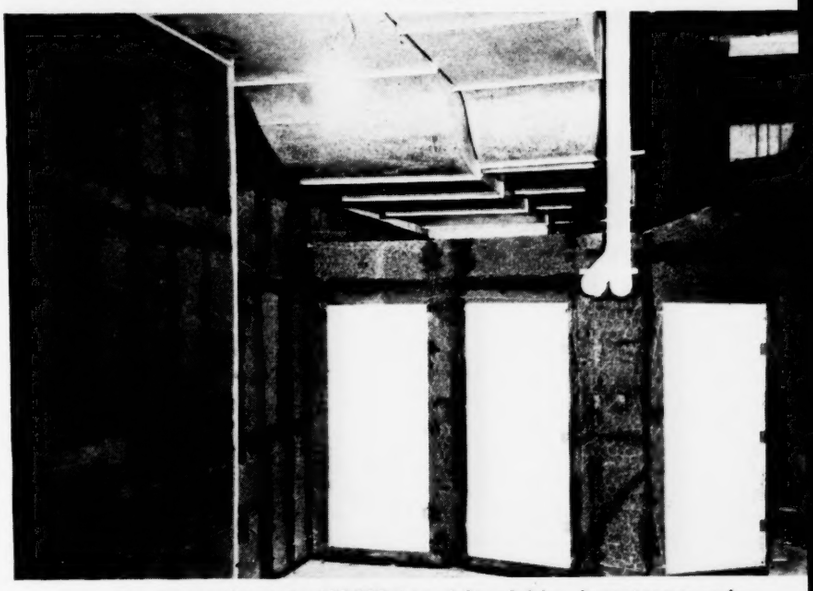
The air conditioning system, which takes care of approximately 262,000 sq. ft. of floor area and 4,200,000 cu. ft. of volume, includes 21 supply fans circulating 416,000 c.f.m., or 1.58 c.f.m. per sq. ft., or six air changes per hour, and 21 return fans handling 404,000 c.f.m. The minimum outside air supplied is 113,000 c.f.m., which, with a maximum population of 2100 people, equals 54 c.f.m. per person. The 21 dehumidifiers handle a total of 328,000 c.f.m. and the air washer pumps in connection handle 5000 gallons of water per minute.

One of the features of the air conditioning system is the method of reducing the solar heat gain to the main floor galleries. In order to obtain as much natural light as possible in these galleries, lay lights were installed instead of ceilings and above the lay lights there are sky lights with an air space in between. Ordinarily, during periods of intense sunshine, the temperature of the air in these spaces would rise tremendously with a consequent excessive load on the air conditioning and refrigerating systems. On this project supply and exhaust systems were provided to give a rapid change of air in these spaces and thereby carry off a large percentage of the solar load before it could become effective in the air conditioned areas. Altogether, there are 14 supply and 14 exhaust ventilation fans to take care of this item of 25,000 c.f.m. capacity each, making a total of 700,000 c.f.m. handled.

Besides the above mentioned fans there are 25 additional supply and exhaust ventilation systems handling 382,000 c.f.m. in connection with general areas, kitchen, refrigeration room, steam meter room, toilets, and the like. Altogether, there are a million and a half pounds of sheet metal used in the air conditioning ducts.

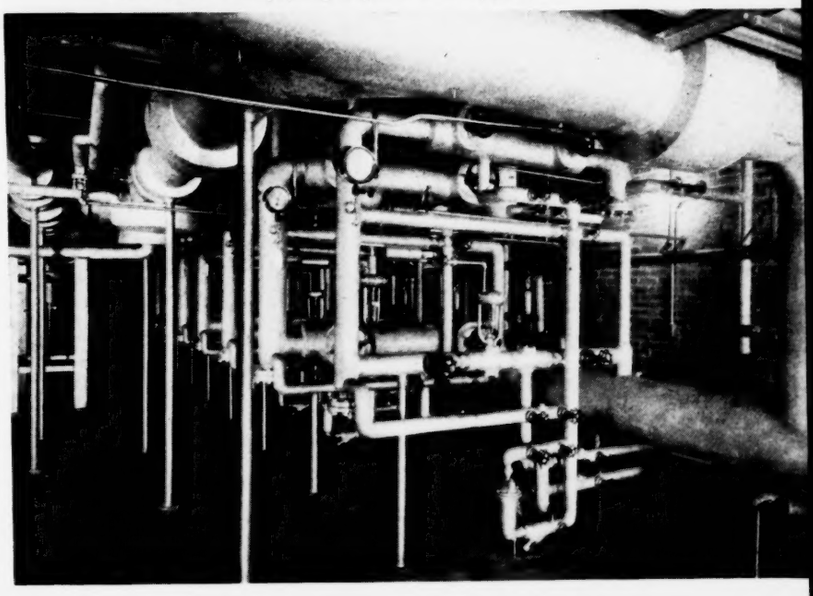


10. Note the cerfed cork board to permit shaping to the exact contour of the fan housing.



11. Approximately 400,000 board ft. of 1-in. Armstrong cork board was used on the ducts and fans. This view shows 1½- and 2-in. cork board on a dehumidifier.

12. Note neat piping layout and application of insulation.



2. Chilled water pump in the foreground, refrigeration compressor in background.

3. Instrument board for the conditioning system, with temperature and humidity indicators.

4. Ductwork for conveying properly conditioned air to the various galleries in one zone; there are 21 zones.

5. A battery of condenser water pumps. All of piping here is aluminum-painted.

6. One of the 17 air conditioners which includes filters, preheating coils, and sprays.

7. An outside air intake. The largest duct is 4 ft. x 19 ft. in cross section.

8. One of the Carbondale refrigerating compressors.

9. A view in the refrigerating room. The space in the foreground allows for expansion of another unit when additional gallery space is finished on the floor above. Front cover illustration shows the exterior of the National Gallery of Art.

THE EDITOR'S PAGE

Criticism of the construction industry is an old story. It reached scandal proportions after the World War. After this one there may again be mud slinging at what is now being done in defense building.

The answer has already been made—by William H. Harrison, director of the construction section of the National Defense Advisory Commission, speaking before the New York Building Congress:

"In retrospect, some may ask: 'Could a better and lower-cost job have been done?' Surely. 'Could it have been done within the time limit specified?' No. Of one thing we may be sure: construction history is now in the writing. . . . The net product of it all can never be measured from any esthetic standpoint. It can't be measured from a utilitarian standpoint, or from the standpoint of good or bad design, or good or bad construction. There has been some of both. It can be measured only in terms of the tremendous value that it all has for our whole national security.

"Should any of you men some day, somewhere, be called upon to sit in sober judgment on the merit of this or that procedure of design or construction, I hope that in the charity of your hearts you will reflect upon the conditions under which the work had to be done."

◆

Air conditioning, by an ingenious definition of Parks-Cramer Company, is the control of four M's—Mercury, Moisture, Motion, and Microbes. Knowing what can now be done in restaurants, wash rooms, and industrial plants, to name a few, we suggest the addition of a fifth M—Malodor.

◆

Pittsburgh refuses to accept the cellar position in the smoke league. Lively discussion is still under way there among boiler firemen, the local medical society, health inspectors and smoke inspectors, climaxed by an address on smoke control in the First Baptist Church one Sunday evening. The city smoke inspector charged Detroit, Cincinnati and Chicago with outranking the Iron City as smoky cities. Apparently spurred by the St. Louis results, the health inspector has challenged Cincinnati to a "smoke duel." No report as yet from Chicago or Detroit.

One factor in connection with defense housing that does not seem to have received adequate attention—and this is purely opinion—is the increased mobility of workers. Unlike the 1918 days, the majority of factory workers today have cars, and a trip of even ten or fifteen miles to and from work is not serious. A recent study in California seems to have been the first to develop any reliable information on this point. This study showed that 80% of the men in one large plant drove at least 10 miles. The conclusion would seem to be that existing buildings in a 20-mile circle should take care of a good portion of the housing needs around a given project, and that the defense housing boom may be of relatively small proportions.

◆

Last month's issue carried a news item which we printed with genuine pleasure—that relating to the awarding of an honorary doctor's degree to F. C. Houghten. Mr. Houghten has, it seems to us, long been in the unsung hero class. As director of the ASHVE research laboratory he has necessarily had to conduct a wide range of complex projects and at the same time exercise considerable tact in his relationships with individuals and groups having quite different interests and objectives. This he has done with distinction. We believe that the Olivet trustees, as well as Dr. Houghten, deserve congratulations.

◆

In the early days of the great depression it was generally agreed that public works were badly needed to provide work and a market for equipment; unfortunately, there was a discouraging time lag before such projects were initiated, since no plans were ready. That this may be avoided in the coming post-war days is indicated by the latest report of the National Resources Planning Board. The report urges that a revolving fund be established to finance preparation of plans and specifications for post-war public works. The Board wants $85 million now; this would be subtracted from future projects and used for still later projects, and so on.

This would appear to be very wise planning for a future rainy day.

As is to be expected the civil engineering press is much occupied with the controversy over the Tacoma Bridge failure. In commenting on this disaster, Professor Finch of Columbia makes a point of interest to all engineers. He states that it is asking too much of the human mind to suggest that the engineer should have anticipated the Tacoma failure, and goes on to say that it is a mistake to assume that failures should never occur; that the engineer can not wait until he knows "all" about a device before he builds it; that in general theory follows practice, and that there is no substitute for experiment.

Bridge engineers apparently have something yet to learn of aerodynamic phenomena; air conditioning engineers have much to learn about, for example, heat lag. Failures in design are wasteful but they instill a probably necessary humility in approaching other projects.

◆

The march of events in Washington is far too rapid for anyone to keep up with; it is difficult even to keep abreast of developments in a given specialized field.

Only a few months ago no thought whatever was being given in official circles—as far as we were able to determine—to bomb shelters, a type of construction necessarily involving ventilation. Word now comes from Washington that the new Naval Appropriations bill contemplates construction of several million dollars worth of such shelters for outpost stations in the Pacific. Perhaps by the time this is printed, proposals for bomb shelters will have been made for the mainland.

◆

No heating and ventilating engineer, it seems, need be unemployed today. If for any reason you are, register at once with the Civil Service Commission.

◆

The returns on 1941 construction are now coming in; the plans and specifications are rapidly being converted into contract. New high records have been made for construction contracts for the first two months of the year in the Mid-west, New England, the far West and southern states, while highest-since-1929 figures have been recorded for the Middle Atlantic and west of Mississippi states.

MIXING OF HOT AND COLD WATERS—2

TABLE 2.—PERCENTAGE OF THE MIXTURE WHICH IS HOT WATER WHEN HOT AND COLD WATERS ARE MIXED TO PRODUCE A WARM WATER AT A SPECIFIED INTERMEDIATE TEMPERATURE.

Temp. of Mixed Warm Water, F	Temperature of Cold Water Supply—F																									
	40	50	60	70	80	90	100	40	50	60	70	80	90	100	40	50	60	70	80	90	100					
	210F Hot Water Supply							200F Hot Water Supply							190F Hot Water Supply											
200	94	93.7	93.3	92.8	92.3	91.7	90.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
190	88	87.5	86.7	86	85	83.3	82	93.7	93.3	92.8	92.3	91.7	90.9	90	—	—	—	—	—	—	—					
180	82	81	80	78.5	76	75	73	87.5	86.7	86	85	83.3	82	80	93.3	92.8	92.3	91.7	90.9	90	88.8					
170	76	75	73.3	71	69	67	64	81	80	78.5	76	75	73	70	86.7	86	85	83.3	82	80	78					
160	71	69	67	65	61.5	58	54.5	75	73.3	71	69	67	64	60	80	78.5	76	75	73	70	67					
150	65	62	60	57	54	50	45	69	67	65	61.5	58	54.5	50	73.3	71	69	67	64	60	55.5					
140	59	56	53	50	46	41.5	36	62	60	57	54	50	45	40	67	65	61.5	58	54.5	50	44					
130	53	50	46	43	38	33	27	56	53	50	46	41.5	36	30	60	57	54	50	45	40	33					
120	47	44	40	36	30.5	25	18	50	46	43	38	33	27	20	53	50	46	41.5	36	30	22					
110	41	37.5	33	28.6	23	16.7	9	44	40	36	30.5	25	18	10	46	43	38	33	27	20	11					
100	36	31	26	21	15	10	—	37.5	33	28.6	23	16.7	9	—	40	36	30.5	25	18	10	—					
	180F Hot Water Supply							170F Hot Water Supply							160F Hot Water Supply											
180	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
170	92.8	92.3	91.7	90.9	90	88.8	87.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
160	86	85	83.3	82	80	78	75	92.3	91.7	90.9	90	88.8	87.5	85.7	—	—	—	—	—	—	—					
150	78.5	76	75	73	70	67	62.5	85	83.3	82	80	78	75	71	91.7	90.9	90	88.8	87.5	85.7	83.3					
140	71	69	67	64	60	55.5	50	76	75	73	70	67	62.5	57	83.3	82	80	78	75	71	67					
130	65	61.5	58	54.5	50	44	37.5	69	67	64	60	55.5	50	43	75	73	70	67	62.5	57	50					
120	57	54	50	45	40	33	25	61.5	58	54.5	50	44	37.5	28.6	67	64	60	55.5	50	43	33					
110	50	46	41.5	36	30	21	12	54	50	45	40	33	25	14	58	54.5	50	44	37.5	28.6	16.7					
100	43	38	33	27	20	11	—	46	41.5	36	30	21	12	—	50	45	40	33	25	14	—					
	150F Hot Water Supply							140F Hot Water Supply							130F Hot Water Supply											
150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
140	90.9	90	88.8	87.5	85.7	83.3	80	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
130	82	80	78	75	71	67	60	90	88.8	87.5	85.7	83.3	80	75	—	—	—	—	—	—	—					
120	73	70	67	62.5	57	50	40	80	78	75	71	67	60	50	88.8	87.5	85.7	83.3	80	75	67					
110	64	60	55.5	50	43	33	20	70	67	62.5	57	50	40	25	78	75	71	67	60	50	20					
100	54.5	50	44	37.5	28.6	16.7	—	60	55.5	50	43	33	20	—	67	62.5	57	50	40	25	—					

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MIXING OF HOT AND COLD WATERS—2

It is becoming more and more common practice to obtain service hot water at a given temperature by mixing cold water with water drawn from a supply kept at a temperature higher than the temperature of use. Such a method is especially important where there is only a single hot water storage tank but where service hot water must be available at a wide variety of temperatures depending on the purpose for which it is to be used. For the usual purposes, hot water is seldom required at a temperature greater than 160 to 170F while for many of the common operations hot water is needed for no higher temperature than 90 to 100F. (For information on temperatures of hot water suitable for common operations see HEATING AND VENTILATING's Reference Data 191-192.)

The storage temperature of hot water, the temperature of the cold water supply, and the temperature of the hot water required are all closely related and all are of importance in deciding on the size of storage tank and on the amount of heat transfer surface required.

The Table on the other side of this sheet has been prepared so that once the temperature of the cold water supply and the temperature of the hot water supply are known, the percentage of the mixture which is hot water can be determined at once.

Example: In a certain restaurant there is a single hot water storage tank maintained thermostatically at 180F. During the winter cold water is available from the city mains at 50F. The dishwasher requires mixed warm water at a temperature of 130F for washing and a temperature of 170F for rinsing. Equal amounts of hot water are required for both operations in the dishwashing, since the maximum demand for each purpose is 100 gal. per hour. Under these conditions what is the maximum demand on the hot water tank for the washer and what is the maximum demand for the rinser?

SOLUTION: First find the condition to fit the requirements of the washer. To do this locate on the Table the rectangle indicating "180F Hot Water Supply." Then in the left hand column locate 130F as the temperature of mixed warm water of the washer, move horizontally until under the column at 50F and find that 61½% of the mixed warm water drawn will be from the hot water supply. Therefore, for every 100 gallons per hour supplied to the washer, the maximum demand on the hot water supply tank will be 61.5 gal. per hour.

Then find the condition to fit the requirements for the rinser. The 180F hot water supply remains the same but since the temperature of the mixed warm water must be 170F, locate this temperature in the left hand column and move horizontally until under the 50F cold water supply temperature and find that 92.3% of the warm water mixture is drawn from the hot water supply. This is the same as saying that for every 100 gallons per hour supplied to the rinser the maximum demand on the hot water tank is 92.3 gal. per hour.

Thus it is apparent that in spite of both operations using the same amount of warm water, the maximum demand for the rinser is approximately one and one-half times the maximum demand on the storage tank to meet the requirements of the washer.

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H. & V.'s REFERENCE DATA—196

Still More Defense Building Planned; Program Continues to Expand

Indications from Washington are that the Defense construction program has not only not reached its peak but that new construction is being planned, or proposed, at a rapid rate. An army of four million men may be provided for; the Quartermaster's Corps needs scores of buildings; Navy will build more houses; PBA experimenting with prefabricated houses.

GIVEN the green light by passage of the Lend-Lease Bill, military appropriations measures now before Congress will serve to dispel any suspicion that the defense construction program has reached its peak or that heating, ventilating and air conditioning services and equipment will no longer be in demand on defense projects.

Indeed there is ample evidence that previously announced programs for plant expansions and for the housing of enlisted men and civilian defense workers may soon assume proportions of greater interest than in the past to an industry more concerned with permanent heating and air conditioning installations than in those of temporary nature.

Several factors permit this conclusion. Firstly, with the initial speed-up projects coming out of the "on order" stage, official Washington is consolidating its positions, seeking out flaws that may have developed, and making plans for an "all out" effort when, if, and as occasion may arise. Already on the drawing boards in the War Department are preliminary plans for 22 additional cantonments and into official documents creep veiled references about the possible requirements of an army of 4,000,000 men.

While such references are tempered by the expressed hope that such a move will prove unnecessary, the Armed Forces do not intend being caught off base in any eventuality. Although it is generally conceded in Washington that, considering the speed required, preliminary steps of the construction program have achieved certain desired results, there is indication that changes might prove profitable—changes that may prove advantageous to the heating and ventilating industry.

Recalling the episode of the Maginot line, the Army should probably not be criticized too severely because some of its "M" day plans require revision. As explained to the Subcommittee of the Committee on Appropriations, House of Representatives, by General George C. Marshall, Chief of Staff of the U. S. Army, seeking an appropriation of $236,000,000 for Quartermaster and Air Corps construction not previously announced, uncharted courses confront today's military planners.

"Our purpose and problems defined by the Congress in September of 1940 are essentially different from those of 1917, and in this difference lay most of the deficiencies in the planning and estimates for troop concentrations," said General Marshall.

"Our planning through the years, which went into a myriad of details as to space and structural requirements, did not contemplate an American public being aroused, in time of peace, to the necessity of creating a force of a million and more men for training as a precautionary measure. The troops of 1917 were quartered in cantonment areas for only brief periods of training while awaiting transportation overseas.

"Our present army is being quartered in its areas, we hope, for the entire period of service of most of its members. Not only that, but the recent law on the subject extends our training plan over a period of five years. For such a program the World War cantonment and the ideas behind its construction were not a suitable basis for estimates.

"What we require and what we are building is a type of cantonment adequate for the shelter, sanitation, health and morale of the soldier."

To supplement facilities provided in original plans for cantonments, the Quartermaster Corps has included in the Fourth Supplemental National Defense Bill for 1941 an item of $110,709,910 covering scores of buildings different in type than the initial temporary structures. Included are plans for 604 chapels to be constructed at a cost of $12,816,880; recreational facilities to cost $15,999,897; ice plants to cost $6,750,000; reception and discharge centers to cost $20,685,000; hospital and medical facilities to cost $4,811,944, a $750,000 cold storage plant in Hawaii, as well as motor repair facilities, offices and other buildings of similar types.

The Quartermaster Corps' request, in the same bill, for $15,000,000 for the purchase of land for additional cantonments, is equally significant.

Included in the Air Corps' requirements for $125,290,090 are also many projects of interest from the standpoints of heating and ventilating. Included are the following: At Wright Field, Dayton, Ohio, expansion of existing laboratories, $450,000; propeller laboratory and equipment, $830,000; armament laboratory, $750,000; photographic laboratory, $60,000; soundproofing torque stands, $400,000.

Patterson Field, addition to engine test building, $603,750; Duncan Field, addition to engine test building, $600,000; McClellan field, steam plant, $100,000; three new air depots, $42,000,000; deficiency housing for 12,000 student pilots, $5,000,000.

In the defense plant construction field, encouragement for the heating and ventilating industry lies in the fact that as of March 20 the Radford (Va.) powder plant alone was completed, out of a field of 120 projects previously announced. Others were in various stages of completion and the following 20 were not started as of February 5:

Name and Location	Description
Alabama Ordnance Works, Childersburg, Ala.	Smokeless powder
Coosa Ordnance Plant, Childersburg, Ala.	Bag loading
Denver Small Arms Ammunition Plant, Denver, Colo.	Small arms ammunition
New River Ordnance Plant, Pulaski, Va.	Bag loading
Hoosier Ordnance Plant, Charlestown, Ind.	Bag loading
Anniston Ordnance Depot, Anniston, Ala.	Ordnance storage
Ravenna Ordnance Depot, Ravenna, Ohio	Shell loading
Umatilla Ordnance Depot, Umatilla, Ore.	Ordnance depot
Wingate Ordnance Depot, Fort Wingate, New Mexico	Storage depot
Edgewood Arsenal, Edgewood, Md.	Chemical warfare plant
Fostoria, Fostoria, Ohio	Noncoconut charcoal plant and whetlerite plant
Midland, Midland, Mich.	Chemical warfare plant
Niagara Falls, Niagara Falls, N. Y.	Chemical warfare plant
Monsanto, Monsanto, Ill.	Chemical warfare plant
Atlanta General Depot, Atlanta, Ga.	Storage other than explosives
Columbus General Depot, Columbus, Ohio	Storage other than explosives
Jeffersonville Quartermaster Depot, Jeffersonville, Ind.	Storage other than explosives
San Antonio Quartermaster Depot, San Antonio, Texas	Storage other than explosives
Plum Brook Ordnance Works, Sandusky, Ohio	TNT and DNT manufacturing

A further key to the *unfinished business* stage of the plant expansion program is included in the Fifth Supplemental National Defense Appropriation Bill for 1941, currently receiving Congressional attention. Quoting from General Marshall's presentation before the House subcommittee of the Committee on Appropriations:

"The 1942 estimates as approved for transmission to the Congress included for expediting production $498,367,500 in cash appropriations and, in addition, $195,867,500 for contract authorizations, a total of $694,235,000. As a result of a detailed restudy of requirements, this estimate (The Fifth Supplemental Bill) includes $292,000,000 in cash and $576,396,000 in new contract authorizations. The procurement program will be materially expedited by advancing the authority to place contracts."

That Navy's share of construction in 1941-42 does not contemplate a relaxation of the present program is indicated by a request for $186,115,000, included in the Fourth Supplemental Bill by Admiral Ben Moreell, Chief of the Navy's Bureau of Yards and Docks, in charge of construction and maintenance of all shore establishments for the Fleet.

While details of the Navy's program have not been released, it is known to include more than $15,000,000 worth of barracks and other housing at Naval stations and nearly $5,000,000 in hospital construction or improvement.

In addition to the defense and housing programs as they apply to the Armed Forces, Congress is also giving its attention to an omnibus bill which would appropriate approximately $300,000,000 for additional construction in the vicinity of population centers created by defense activities. As was the case with Lanham Bill appropriations, such a fund would probably be administered through the Public Works Administration. Public Buildings Administration, under PWA, will find the program divided into two units of $150,000,000 each—one for defense housing of civilian workers; the other for schools, recreational facilities and the solution of public utilities problems arising in the vicinity of civilian defense areas.

Currently PBA is launching an interesting experiment in prefabricated housing at Indian Head, Md., where a dozen manufacturers of houses of this type have been given contracts to erect units of 50 houses each. The result will be a test community of several types of prefabricated houses made from different materials and with varied construction features. Upon the results of this test it is expected that future policies of PBA with regard to prefabrication will be predicated.

Officials of PBA explain that during the first stages of the construction program, when speed was a paramount requirement, so many obstacles to the prefabricating program developed that little use was made of this form of construction. Another consideration was that, anticipating the necessity of disposing of houses at the close of the emergency period, PBA sought a source of demountable prefabricated houses with little success. In the meantime manufacturers have perfected this feature and it is expected that the test dwellings at Indian Head will be constructed in such a way that they may be taken apart and moved to other locations when the need for them has passed.

Although it would appear that the defense program, either directly or indirectly, will put the heating and ventilating industry into high gear during the balance of this year, there is still another way in which manufacturing members may make certain of an opportunity to participate in the program. This is through enrollment of manufacturing facilities with a view to accepting contracts for the production of war materials, in part or in their entirety.

With a view to spreading defense orders widely through the assistance of sub-contractors who may have idle facilities, the Division of Production, Office of Production Management, is making a national census of potential volume through its subsidiary, the Defense Contract Service.

It has been estimated that while machine tools comprise a bottleneck seriously interfering with the defense program, not more than 50% of the nation's tooling capacity is currently engaged in turning out defense orders. With the objective of enrolling all possible sources of tooling or metal-working production, the Defense Contract Service has been organized to collect information through the 12 Federal Reserve banks and their 24 affiliated branch banks.

In each of the 36 banks is a district manager qualified to handle all inquiries with regard to the sub-contracting program. It is suggested by Robert L. Mehornay, director of the Defense Contract Service, that all interested manufacturers, large or small, contact the nearest district office at once in order that the Nation's roster of productive capacity may be complete.

A similar roster for the individual heating or ventilating engineer who desires to place his name on record with future service to the Government in mind, is maintained at Washington, D. C. Inquiries regarding this roster should be addressed to Leonard Carmichael, Director, National Roster of Scientific and Specialized Personnel, Atlantic Building, Washington.

ABSTRACTS of Current Papers, Books and Pamphlets

Temperature

In a book on lighthouses published some years ago the author pointed out that the need for lighthouses was a fundamental one and that even belligerents in a war spared each other's lighthouses.

To a heating and air conditioning engineer a comprehensive book on temperature is just as fundamental as lighthouses to a maritime nation. Such a book is now available under the title "Temperature—Its Measurement and Control in Science and Industry." It is a collection of papers presented at a symposium held in New York a year ago under the auspices of the American Institute of Physics, National Bureau of Standards, National Research Council and 12 scientific and technical societies. Fundamental knowledge in the field of temperature and its measurement is exhaustively covered in this one volume which is really an encyclopedia on the subject. The papers included number 125 whose scope ranges from the closest possible approach to absolute zero to the temperature of the stars and from the production and loss of heat in the body to the temperature of volcanoes.

The book is divided into 13 chapters, as follows: Temperature and Temperature Scales, Precision Thermometry, Education, Natural Sciences, Temperature in Biology, Temperature and Its Regulation in Man, Automatic Temperature Regulation and Recording, Special Applications and Methods, General Engineering, Metals and Ceramic Industries, Oil Industries, Optical and Radiation Pyrometry, and Thermometric Metals and Alloys.

Of the above the chapters on Man's Temperature Regulation, Automatic Temperature Regulation and Recording, and General Engineering are of the most immediate value to the heating engineer. Of particular interest in the first of these chapters are the papers on Man's Heat Exchanges with His Thermal Environment, by Dr. C.-E. A. Winslow of the John B. Pierce Laboratory of Hygiene; Heat Loss and Heat Production in Women Under Basal Conditions at Temperatures from 23C to 35C, by Drs. J. D. Hardy, A. T. Milhorat, and E. F. Dubois of the Russell Sage Institute of Pathology; The Significance of the Average Temperature of the Skin, by Drs. Hardy and DuBois of Russell Sage, and Standard Operative Temperature, a Single Measure of the Combined Effect of Radiant Temperature, of Ambient Air Temperature and of Air Movement on the Human Body, by A. P. Gagge of the Pierce Laboratory.

Of interest in the last of the chapters mentioned is the paper on Measurement of Surface Temperatures, by F. C. Houghten and Harold T. Olson, ASHVE Research Laboratory.

[*"Temperature—Its Measurement and Control in Science and Industry." Published by the Reinhold Publishing Corporation, 330 W. 42nd St., New York. Cloth bound, 1362 pages. Price, $11.*]

Air Conditioning Principles

A specialized book on air conditioning, entitled Air Conditioning Principles, has recently been published as one of the International Texts in Mechanical Engineering. The book is intended for undergraduate and graduate engineers who have had basic courses in thermodynamics, fluid flow and heat transfer. The book is confined to processes and makes no attempt to deal with equipment or practice.

The author, Charles Osborn Mackey of Cornell, professor of heat power engineering at Cornell University, is well equipped to write such a book. He was, five years ago, co-author with Dr. Willis Carrier of an ASME paper dealing with the contact mixture analogy in psychrometry. Some years before that he prepared for HEATING AND VENTILATING a series of articles covering all the then available psychrometric charts; more recently he has prepared a useful and original method of calculating solar heat gains, a series of which one part appears in this issue.

Dr. Carrier has prepared a foreword to the book in which he says: "In this text (the author) has not only successfully integrated previous developments by others of the theory of the art, but in many instances has rounded out both the theory and its application with further developments of his own. These original developments constitute a distinct advance in the application of scientific and mathematical principles to the air conditioning art. Among such original contributions deserving of special mention are the following:

"1. A further development of the Arnold theory of the wet bulb temperature, its reconciliation with existing, experimental data and the extension of this theory to all processes involving evaporation and condensation. . . .

"2. A new psychrometric formula is given in Chapter 1. This is to be commended both for its convenience and accuracy.

"3. The application of the 'Contact Mixture Theory' to the convenient solution of problems in humidification, dehumidification, cooling and heating of air. . . .

"4. The estimating of variable heat flow through sunlit walls. . . .

"5. Especially to be commended throughout the test is the use of the graphical illustrations and solutions of humidifying and dehumidifying. . . . Special attention should be called to the alignment chart for the solution of air conditioning problems in humidification. . . ."

This book can be highly recommended not only to younger engineers but to older ones as well. This recommendation is made with one reservation—the book is not suitable for one who has not had a good groundwork in thermodynamics.

[*"Air Conditioning Principles," by Charles Osborn Mackey. Published by International Textbook Co., Scranton, Pa. Cloth bound, 6 x 9 in., 210 pages. Price, $2.*]

The Guide

The 46 chapters of the Heating, Ventilating, Air Conditioning Guide have been rearranged and grouped into seven sections in the 1941 (19th) edition. Twenty-one chapters have been reviewed or rewritten and minor changes have been made in the other 25 chapters.

An entirely new chapter on thermodynamics of air and water mixtures is presented, based on the most recent information available on the subject. In addition to the Bulkeley psychrometric chart a new Mollier diagram for moist air is included for use in analyzing air conditioning processes. The chapters on cooling, dehumidification and dehydration, and refrigeration are completely new.

The chapter on heat transmission coefficients and tables contains some new data developed by recent research investigations. The table of climatic conditions in the chapter on heating load has been enlarged by adding a column on recommended design temperatures. In the chapter on cooling load will be found new data on solar heat transmission through walls, roofs and glass blocks, resulting from investigations by the ASHVE Research Laboratory.

New material on the design of cooling towers is included in the chapter on spray equipment. The chapters on air duct design, sound control and automatic control have been rewritten. The old chapter on railway air conditioning has been rewritten and is now called transportation air conditioning. Information on buses and automobiles has been added and references to air conditioning of ships and airplanes are included.

[*"Heating, Ventilating, Air Conditioning Guide, 1941," published by the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. Cloth bound; 9 x 6 in., 1120 pages. Price, $5.*]

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Water for Hotels

There are still a great many gaps in our knowledge of water consumption for different purposes, and among the notably weak spots in the available data is reliable information on water consumption for the component services in hotels. In addition, it is reported that the cost of water to hotels is on the increase, some of which is due to air conditioning, some to increase in rates, and probably in some parts even due to the slow but steady increase in frequency of bathing.

Consequently, the problem of water costs has become more and more serious to hotel operators and, therefore, to engineers interested in this particular type of building. Unfortunately, with the exception of a few of the larger hotel chains, the majority of hotels is unable to make any too exhaustive a study of their water consumption, due to the fact that they have no common denominator with which to compare their individual consumption figures.

This need has now been met by a survey made for the American Hotel Association of the United States and Canada, by Georges C. St. Laurent of Wegg and St. Laurent, hotel consultants, as the first of a series of studies on hotel engineering.

The report, covering water consumption, costs, and savings, gives detailed figures on individual hotels broken down into classifications based on the number of rooms and further broken down by the type of water consuming equipment operated by the hotel, including refrigeration, air conditioning, laundries, kitchens, and so on. This is probably the most complete set of data so far made available on water consumption in hotels and it can be recommended to engineers whose practice deals with this type of work.

Three other books on the same series, to appear at a later date, will cover electric current; fuels, including steam; and payroll and personnel.

[*"Hotel Engineering—Volume 1, Water Consumption, Costs and Savings," by George C. St. Laurent. Published by the American Hotel Association of the United States and Canada, 221 W. 57th St., New York. Paper cover, 10½ x 7¼ in., 32 pages. Price, $1.*]

Handbook of Fire Protection

A revised edition of a book which has appeared since 1896 and included in which is an entirely new section on detailed information concerning the hazards and fire protection of air conditioning systems. Each chapter of the Handbook has undergone numerous revisions and changes since the last edition five years ago. The handbook includes material of interest to heating and ventilating engineers on such subjects as chimneys, blower systems, furnaces, boilers, flammable liquids, dust explosions, spontaneous heating, tanks, sprinkler systems, and an important section of tables and charts.

[*"Crosby-Fiske-Forster Handbook of Fire Protection," Ninth Edition. Published by the National Fire Protection Association, Boston, Mass. Cloth bound, 7 x 4½ in., 1308 pages. Price, $4.50, postpaid.*]

BRIEF REVIEWS

Solar Heating. One of the National Bureau of Standards series on Building Materials and Structures. This publication is a report on an investigation by the Bureau in connection with low cost housing in order to determine the relative absorption of heat from the sun by various materials or surfaces which are or might be used on roofs. Various types of paints, roof shingles and foils were studied. [*"Solar Heating of Various Surfaces," by Herman V. Cottony and Richard S. Dill, Building Materials and Structures, Report BMS64, published by the National Bureau of Standards. Paper cover; 8½ x 11 in., 5 pages. For sale by the Superintendent of Documents. Price, 10 cents.*]

Stoker Performance. A 16-page pamphlet devoted to the effect of stack damper setting or furnace draft on stoker performance, and containing the results of research conducted by The Koppers Coal Company. Includes four graphs and two drawings. [*"Effect of Stack Damper Setting or Furnace Draft on Stoker Performance." Booklet No. 1 published by The Koppers Coal Company, Pittsburgh, Pa. 4 x 7 in. 16 pages. Available to retail coal merchants, domestic stoker distributors and their personnel.*]

NEWS OF THE MONTH

Oil Burner Industry Holds Convention and Show in Philadelphia; Exposition Has 104 Paid Exhibitors; 3000 Attend

PHILADELPHIA—A highly successful, from every point of view, convention and exposition was held by the Oil Burner Institute at the Benjamin Franklin Hotel and Convention Hall, March 17-22, with over 3000 members of the oil burner industry registered for the convention and attending the exhibition of 104 paid exhibitors. Abstracts from some of the talks presented at the convention follow.

P. S. Russel, manager of the oil burner control division of Detroit Lubricator Company, spoke before the Accessory Division on "How the Oil Burner Manufacturers Can Better Help the Accessory Manufacturers." Mr. Russel reviewed the part played by the supplier of accessories in the development of the oil burner and urged closer collaboration and cooperation in meeting problems. He told those present some of the problems of the supplier and to illustrate this mentioned the following:

"Some years ago we produced an industrial type of thermostat. This thermostat was so designed that by reversal of inside parts it would either 'make' or 'brake' on temperature rise: by different liquid charges its temperature range would be made higher or lower, making it applicable for refrigeration or heating, or for use as a safety control. It could have a wide differential or a close differential.

"We believed that to meet all requirements we might be called upon to produce maybe as many as 100 and possibly 150 different types of the same industrial thermostat.

"We have made the instrument for a number of years. We are still producing it. There are now more than 3800 different specifications which we from time to time are called upon to deliver, and there are approximately 1100 more that have been obsoleted.

"I think we will all agree that probably with 500 different modifications from which the manufacturer could choose he should find something in standard specifications meeting his requirement.

"To a vastly greater degree than normally is it important in 1941 that manufacturers do not ask for anything different than standard unless it be definitely necessary."

In a talk on "Sales and Sales Defense," W. A. Matheson, vice president of Williams Oil-O-Matic Heating Corporation, speaking at the Merchandising Session, said that "Today we can be more certain of gain from our efforts than at any time in the business lives of most of us. We have much to evidence this on all sides.

"First, we have all the spending on the part of the Government for defense materials. An analysis of our business shows that most of our gains are coming from those areas where war industries are most active.

"Second, a created and accumulated desire to own automatic heat, kept alive by good selling methods, has been long deferred, and is now for the first time well on the way toward being satisfied.

"Third, there has rarely been so general an attitude of confidence of a business boom for the entire country —and people buy most when the future is brightest.

"These conditions will, in the belief of most, reach a peak in about April of 1942. At that time Government spending will have hit its full stride. Then, for sometime to come, a high plateau of prosperity will be felt. We in business, selling, and making, and selling again, will be strong factors in the length of time this condition will prevail."

Speaking before the Engineering Session, Ross M. Sherman, chairman of the session, said that:

"Engineering effort is the alpha and omega of this industry. It is the beginning and the end of each installation. The oil burner starts in the engineering laboratory and it is the engineers and service men who finally install it and see that the customer gets the proper service.

"Too often the importance of the engineers and mechanics in this industry is dimmed by the more spectacular and brilliant merchandising and selling departments, but who remembers any great merchandising effort of yesterday?"

Mr. Sherman also referred to the gratifying interest of the public in the industry's Commercial Standards and said:

"And how vitally important this work of standards may become in the defense program no one can foretell. Certainly with the need for conservation of fuel and materials such products are bound to have a more prominent place in the defense program if they are economic with fuel and do not require continual replacement of parts.

"The public should be told not only of these things but the savings in electrical consumption which are very definite under Commercial Standards. They should be made to realize that adequate factory testing assures trouble-proof installations and directly affects maintenance costs. The public should be educated in the meaning of the oil burner certificate and taught to demand one with the oil burner installation. For the first time in history the public has a definite yardstick by which to measure oil burners as compared to competitive fuels, and the public confidence that comes through a thorough knowledge of Commercial Standards cannot help but lift this industry to higher and more desirable growth."

The work of the National Bureau of Standards in connection with heating was reviewed by R. S. Dill, mechanical engineer of the Bureau, speaking before the Engineering Session. He explained the boiler testing procedure and described the brick chimneys adjacent to the boiler shed built for experimental purposes. Reference was made also to the test bungalow where work has been done to find a means of comparing the quality of heating attained with various heating devices. He said: "At present the criterion is the temperature gradient from room to room in the house

BOARD OF DIRECTORS OF OIL BURNER INSTITUTE

(Left to right): Standing—E. P. Bailey, National Airoil Burner Co.; C. B. Tamm, The Heil Co.; Herbert Gillis, Malleable Iron Fittings Co.; Earl Marr, Airtemp Division, Chrysler Corp.; F. H. Van Blarcom, Lynn Products Co. Seated: M. A. Powers, The Timken Silent Automatic Division, The Timken-Detroit Axle Co.; R. G. Whipple, Williams Oil-O-Matic Heating Corp.; W. J. Smith, Cleveland Steel Products Corp.; J. L. O'Brien, Cleveland Steel Products Corp.; R. M. Sherman, Silent Glow Oil Burner Corp.

and vertically in the rooms. Several floor furnaces, space heaters, and stoves have been tried as well as a space heater, on the first floor, connected to a plenum chamber over head in the hall. Also a hot water heating system, natural circulation, with two boilers, one burning coal and one burning oil, has been tried. The arrangement was such that the oil burning boiler could be cut off and the hand fired boiler put into use in a few minutes so that the same climatic condition, existing on the same day, could be utilized. The results of this type of test indicate that a vertical temperature gradient of about 12F in any room from two inches to 60 inches from the floor on a day when the outdoor temperature is 32F should be acceptable on a basis of what these devices, which have had some acceptance by the public, are capable of attaining.

"As an incidental test, the radiators in the living room and kitchen of the house were disconnected and were equipped with electric heaters with long leads so that the radiator could be heated while placed in any selected position in the room. It was found that placing the radiator on the inside wall made the temperature at the 2-inch level about 4F colder when the room was maintained at 70F at the 30-inch level than when the radiator was under the window in its normal position."

Mr. Dill also told his audience about the Bureau's work on heat transmission, particularly through typical wall structures.

The facilities of the Underwriters' Laboratories, Inc., for distributing oil burners were explained by C. R. Welborn, secretary of the Laboratories, speaking before the Engineering Session. Mr. Welborn said that today there are 197 manufacturers of domestic burners and 29 of industrial burners listed by the Laboratories. He then reviewed the work of his organization in connection with the industry's Standards, saying: "The following facts regarding this work to date may be of interest. We have completed tests of products and are operating our Factory Inspection service for safety and CS75-39 Standards in the plants of 53 subscribers on 215 of their models. We have completed the test work for 31 manufacturers on 74 models and await manufacturer action on some details with which their assemblies are not in full compliance with the specifications. We have on our test floor, awaiting CS75-39 tests, 26 models of nine manufacturers. Summarizing the foregoing, 93 of the 197 listed manufacturers of oil burners have submitted 315 models to Underwriters' Laboratories for judgment under your CS75-39 Standard. In most all cases the Label Service has been promptly instituted and the formalities of paper work and similar red tape completed afterwards."

R. K. Thulman, mechanical engineer of the Federal Housing Administration, discussed the requirements of FHA in connection with the oil burner standards. Mr. Thulman said that today a mechanical draft oil burner installed in Long Island homes is a better burner, requires less attention, will last longer, and operates more economically than those installed prior to the formation of the standards. He said that the most important job to be done now is to work out a scheme to curb the tendency to over-fire. In this connection the FHA and its Jamaica and New York City insuring offices have tried using a method of controlling this but including in the standards a clause as follows:

"The firing rate shall be not less than the firing rate for which the burner has received Underwriters' CS-75-39 approval and not more than the firing rate designated on the boiler nameplate or designated for the boiler by the Insuring Office."

Commenting on this, Mr. Thulman said: "While the control of firing rate by this requirement is not perfect, it at least has the virtue of preventing the firing of a boiler requiring only seven-tenths of a gallon per hour with a burner incapable of burning less than a gallon of oil per hour. It is not perfect because it does not prevent the underfiring of a comparatively large boiler and may, for this reason, have to be amplified."

The speaker recommended that the Standard be amended better to control the firing rate and that the firing rate be marked on the burner label. He also called attention to ". . . an abuse of the provisions in the Standard dealing with the question of the service guarantee. The intent of this provision was clearly to provide the home owner with a year's free service. However, in some cases, we have found, where certain installers sublet their service contracts to oil companies, that the oil company has added a clause to the service guarantee which voids that guarantee when the customer ceases to buy oil from that company. We have been able to stop this practice. There have also been cases where the free service provision has been avoided by improper dating of the guarantee. Some owners have found upon moving in their new houses that their service guarantees have already run out. We are attempting to stop these abuses in Jamaica and New York City by requiring that the service guarantee and the test certification be signed by the manufacturer or his authorized representative and no one else and that the service guarantee shall be effective for at least one year from the date of occupany by the mortgagor.

"I recommend that the Standard be amended so that the responsibility both for certification of the test and the free service guarantee be that of, first: The installer and, secondly, if he proves irresponsible, of the builder and that this amendment be drawn up in such a way that the owner is assured a year's free service from the date he occupies his house and so that this free service shall not be contingent upon a continued purchase of oil or any other like condition."

FHA today has made the Standard effective as a requirement in twelve Insuring Offices in addition to Jamaica. These are Boston, Providence, Hartford, New York City, Newark, Philadelphia, Baltimore, Washington, Richmond, Cincinnati, Buffalo and Albany.

In a paper on "Chimneys for Domestic Oil-fired Heating Plants," W. O. Lum, General Electric Company, listed the five factors which affect the performance of the chimney as temperature differential between outside air and the flue gases in the chimneys; the necessity of allowing air into the cellar or furnace room to reach the oil burner; the fact that large massive chimneys often require a long warming up period; the cross-sectional area of the chimney, and the tightness of the chimney.

The following officers were re-elected by the directors of the Institute: president, Ray G. Whipple, Harvey-Whipple, Inc.; first vice-president, E. P. Bailey, National Airoil Burner Co., and second vice-president, J. H. O'Brien, Petroleum Heat & Power Co. C. F. Curtin was reappointed secretary-treasurer of the Institute.

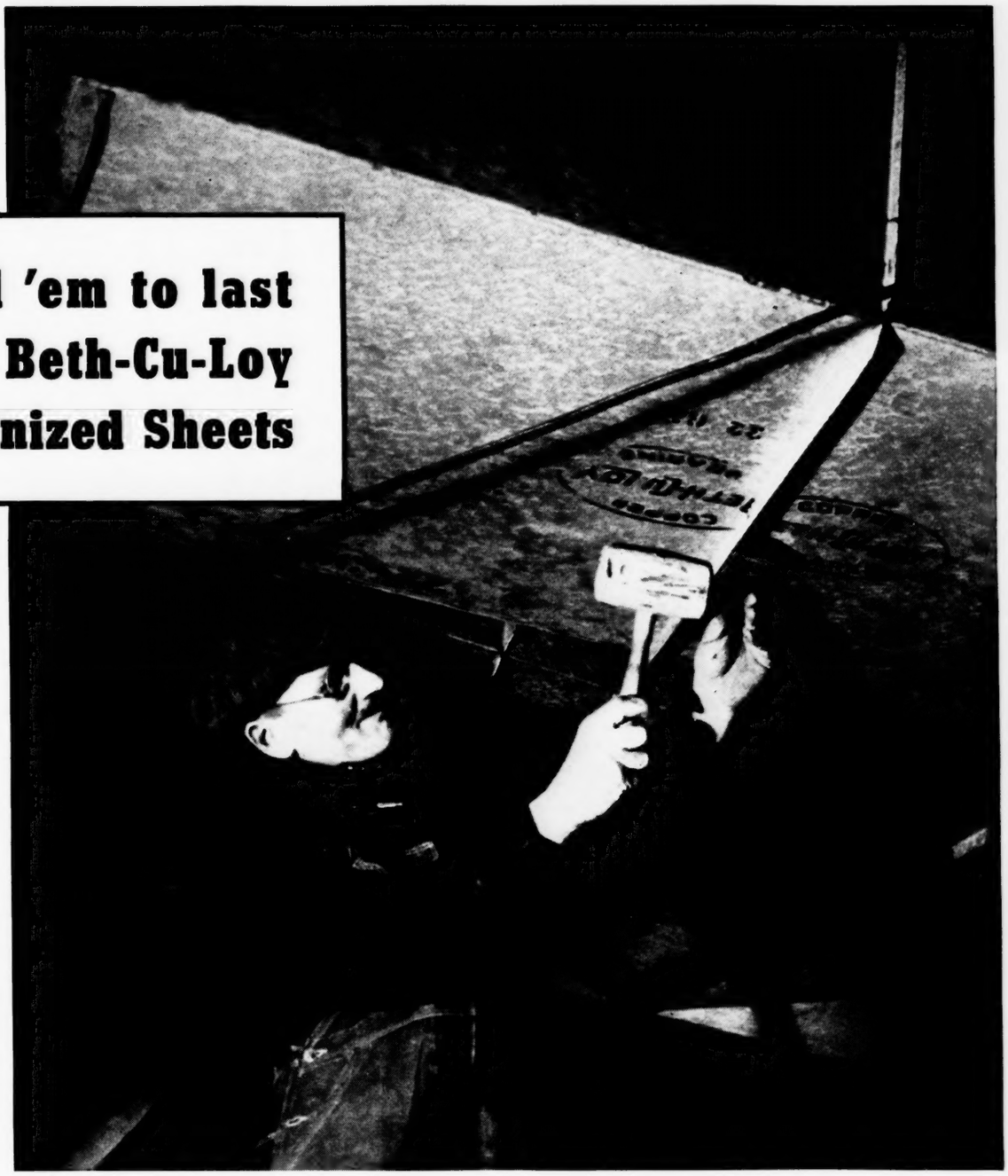
Five directors were re-elected as follows: W. F. Brannan, president, Anchor Post Fence Co.; Earl Marr, general sales manager, Airtemp Division, Chrysler Corporation; M. A. Powers, chief engineer, The Timken Silent Automatic Division, Timken Detroit Axle Co.; W. J. Smith, vice-president, Cleveland Steel Products Corp.; and R. M. Sherman, president, Silent Glow Oil Burner Corp.

New directors elected are H. F. Hildreth, manager, Oil Burner Division, Westinghouse Electric & Mfg. Co., and W. A. Matheson, vice-president, Williams Oil-O-Matic Heating Corp.

The Executive Committee of the Institute re-elected by the directors include Mr. Bailey; F. H. Dewey, Gar Wood Industries, Inc.; C. E. Lewis, Delco Appliance Division, General Motors Sales Corp.; Mr. Powers; A. F. Reif, Reif-Rexoil, Inc.; F. H. Van Blarcom, Lynn Products Co., and Mr. Whipple.

New members elected to the Institute are Williams Oil-O-Matic Heating Corp. and Leland Electric Co.

Build 'em to last with Beth-Cu-Loy Galvanized Sheets



Customer satisfaction is a mighty big item in any business. Yet it's one principal factor for success that's not hard to get and keep. For instance, take the use of Beth-Cu-Loy galvanized steel sheets when you build duct work for a residence or a larger contract.

These quality sheets are made to last. They are doubly protected against corrosion: outside by the tight, heavy coating of prime Western spelter; inside by the addition of 0.20 to 0.30 per cent copper to the steel itself. In tests by an impartial fact-finding body, sheets of similar analysis outlasted ordinary steel sheets by more than two to one.

That's an increase in service life worth thinking about—and you can give your customers this added value at a cost of only a few cents more per sheet—a few dollars more on an entire installation. On your next job, use Beth-Cu-Loy Sheets. Let your customers know about this extra service. Write to Bethlehem Steel Company, Bethlehem, Pa., for your free copy of Booklet 113, containing full Beth-Cu-Loy information.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

ASRE Visits Armstrong Cork

PHILADELPHIA—The Philadelphia section of the ASRE travelled to Lancaster, Pa., March 7, for a joint meeting with the Baltimore-Washington section. The afternoon was taken up with a visit to the plant of Armstrong Cork Company, followed by dinner at the Hotel Brunswick, and business meeting in the evening.

The speakers on the program were H. W. Prentis, Jr., president, Armstrong Cork Company, whose subject was "The Foundation of National Defense"; H. Logan Lawrence, rubber chemicals division, du Pont de Nemours Co., whose subject was "The Uses of Neoprene in Refrigeration Equipment." L. L. Lewis, president of the ASRE, spoke on "What ASRE Offers You."

York to A.C. Republic Furnaces

The contract for air conditioning the blast furnaces of Republic Steel Corporation in Birmingham was, not as reported in the March issue of HEATING AND VENTILATING, awarded to Carrier Corporation but to York Ice Machinery Corporation.

A.C. Installations in Chicago

CHICAGO—There were 2407 central air conditioning installations, totaling 87,940 hp., in the City of Chicago as of December 31, 1940, according to the Air Conditioning Division of the Commonwealth Edison Company. In addition there were 2598 room coolers totaling 1959 hp. in use. The accompanying table summarizes information as to the type of building these systems and units were installed in as well as the year the installation was made.

Bituminous Coal Research Advisory Board Holds Initial Meeting; Progress Reports Submitted on Program Begun November 15

COLUMBUS, OHIO—Meeting at Battelle Memorial Institute here March 3, the technical advisory board of Bituminous Coal Research heard reports on the progress of the program that was started at Battelle for the coal industry November 15. The advisory group is composed of engineers who were recommended by member companies and appointed by Howard N. Eavenson, president of Bituminous Coal Research.

Julian E. Tobey, vice-president in charge of engineering for Appalachian Coals, Inc., was appointed chairman of the board and of a smaller technical executive committee that will guide the program between meetings of the larger board.

The projects now under investigation were selected from those recommended by meetings of fuel engineers held in Pittsburgh two years ago, and in Chicago a year ago. These projects include the development of smokeless hand-fired stoves and furnaces, completely automatic home heating units, gas producers, new firing devices for industrial process heating, and a coal-dust engine. Other projects are a study of dustproofing for porous coals, an information service, and the co-ordination of coal research.

The technical advisory board of Bituminous Coal Research, Inc., at its March 3 meeting at the Battelle Memorial Institute. Inner row, left to right: R. L. Sutherland, Truax-Traer Coal Co.; G. A. Brady, Middle States Fuels, Inc.; G. G. Ritchie, Chesapeake & Ohio Railway; L. A. Shipman, Southern Coal & Coke Co.; H. F. Hebley, Pittsburgh Coal Co.; Mr. Horan; J. Scott, New River Co., and H. R. Limbacher, Battelle. Outer row, left to right: P. Barkman, Cleveland Cliffs Iron Co.; M. A. Tuttle, Knox Consolidated Coal Corp.; L. W. Householder, Rochester & Pittsburgh Coal Co.; F. K. Prosser, Norfolk & Western Railway; Mr. Kaiser, Battelle; R. L. Rowan, General Coal Co.; Mr. Clavin, Battelle; H. N. Eavenson, Bituminous Coal Research, Inc.; J. E. Tobey, Appalachian Coals, Inc.; Ralph A. Sherman, Battelle; C. A. Reed, National Coal Association; Mr. McManus; B. R. Landry, Battelle; Mr. Sholz; J. D. Doherty, Koppers Coal Co.; E. J. Kerr, Island Creek Coal Co.; H. M. Faust, New York Coal Sales Co., and R. F. Stilwell, Red Jacket Coal Sales Co.

SUMMARY OF AIR CONDITIONING INSTALLATIONS IN CHICAGO PROPER
(Compiled by Air Conditioning Div., Commonwealth Edison Co.)

	Prior 1933		1933		1934		1935		1936		1937		1938		1939		1940		TOTAL	
	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.	No.Jobs	H.P.
Amusements	0	0	0	0	0	0	0	0	0	0	1	33	3	107	5	196	10	258	19	594
Banks	5	905	1	200	3	45	0	0	2	428	1	5	3	164	2	23	0	0	17	1,773
Barber Shops	0	0	0	0	0	0	0	0	3	9	1	0	0	0	2	4	2	11	8	25
Beauty Shops	1	4	0	0	3	58	7	46	3	47	3	11	8	33	3	14	2	20	30	235
Brokers & Exchanges	4	694	2	26	3	52	0	0	6	110	0	0	0	0	0	0	0	0	15	883
Churches	1	90	1	5	1	65	1	7	0	0	0	0	3	127	0	0	0	0	7	294
Civic Building	1	450	1	116	0	0	0	0	1	150	0	0	1	30	0	0	0	0	4	746
Clubs	3	357	1	2	0	0	0	0	2	87	3	35	0	0	0	0	1	22	10	503
Dance Halls	4	465	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	465
Doctors & Dentists	0	0	0	0	0	0	0	0	0	0	0	0	4	19	2	2	5	28	11	50
Funeral Parlor	1	1	2	10	5	42	10	107	13	171	15	245	20	173	11	140	24	243	101	1,135
Hospitals	1	30	0	0	1	3	4	47	0	0	0	0	2	7	1	5	2	327	11	421
Hotels	12	3,077	2	72	7	124	2	148	2	32	4	1,087	3	44	3	37	3	131	38	4,754
Industrial-Bakeries	18	303	0	0	0	0	1	1	1	50	1	4	1	15	2	28	1	87	25	490
Candy	19	2,451	3	733	4	381	5	233	11	441	5	177	2	25	8	264	9	176	66	4,881
Printing	13	1,800	1	201	5	98	4	143	2	20	6	462	2	46	1	97	0	0	34	2,871
Misc'l	6	609	3	179	9	353	9	119	8	230	7	635	4	111	10	78	10	311	66	2,628
Gen'l Ofc. & Bldg.	18	4,493	9	265	25	1,561	29	693	56	1,756	60	4,211	53	850	61	740	79	3,654	390	18,225
Private Offices	18	53	13	28	25	90	13	28	18	39	9	23	6	20	10	19	7	15	119	318
Residence	5	33	5	7	5	28	6	14	7	15	14	56	9	38	4	11	4	16	59	221
Restaurant	36	1,389	20	471	29	551	45	1,030	63	1,510	101	1,889	87	1,384	93	1,128	113	1,542	587	10,877
Stores-Candy	0	0	3	12	3	5	8	13	14	71	6	25	13	68	7	34	11	45	65	274
Clothing	3	317	1	3	5	1,051	16	446	15	1,168	16	425	23	443	21	415	29	599	129	4,783
Drug	0	0	0	0	4	99	13	124	13	187	16	175	24	248	39	374	31	345	143	1,551
Food	7	385	0	0	0	0	0	0	3	46	6	44	7	29	15	58	6	25	44	289
Fur	2	2	0	0	2	7	3	13	6	48	6	31	3	16	6	28	9	121	37	269
Shoes	2	14	1	10	4	29	8	55	10	130	25	335	8	64	5	20	4	20	67	700
Misc'l	2	215	3	443	3	167	8	227	14	867	21	406	5	109	11	290	11	190	78	2,916
Studios	1	345	1	9	1	12	2	52	0	0	3	10	7	51	2	20	5	23	19	525
Theaters	52	14,180	10	570	31	2,569	29	1,633	16	1,039	14	1,870	11	671	10	911	11	482	204	23,936
TOTAL	235	32,689	83	3,365	178	7,395	223	5,187	289	8,661	367	12,213	309	4,874	334	4,945	389	8,609	2,407	87,940
Room Coolers																				
Doctors & Dentists	0	0	2	1	2	2	11	7	9	6	25	20	42	25	151	84	161	93	403	238
Private Offices	0	0	19	28	25	41	53	60	73	65	121	126	194	148	366	274	319	259	1,170	1,001
Residences	0	0	8	10	17	11	21	20	43	30	44	60	101	73	267	147	366	226	867	567
Miscellaneous	0	0	0	0	6	5	6	6	9	9	9	46	26	23	70	46	32	17	158	153
TOTAL	0	0	29	39	50	59	91	93	134	110	199	242	363	269	854	551	878	596	2,598	1,959

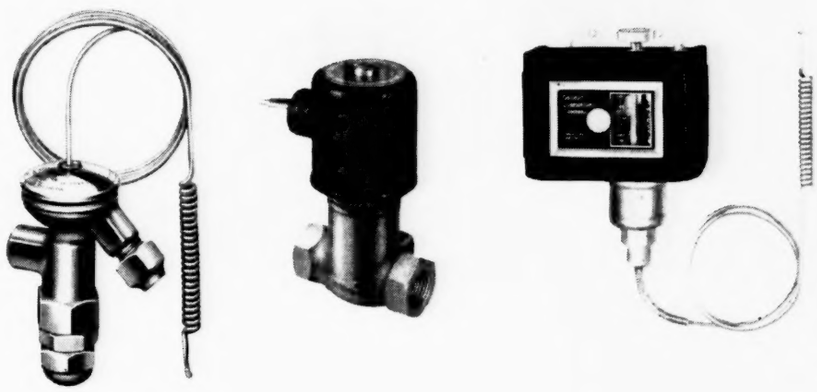
Avoid
DIVIDED RESPONSIBILITY

WHEN you use expansion valves, solenoid valves and controls, all of which are engineered under the same close supervision, you have the best assurance of satisfactory performance and the greatest harmony of operation.

In addition, you have the protection of a single responsibility—no chance of disagreement, no misunderstandings. Under a single responsibility one engineering staff and one manufacturing organization stands back of all your control equipment. You are never in the middle.

Detroit Lubricator Company is the only organization manufacturing expansion valves, solenoid valves and controls. And Detroit Lubricator has made these products since the very beginning of the refrigeration and air conditioning industry, and has pioneered this equipment—all of which means satisfactory performance on your jobs.

Standardize on Detroit valves and controls and make it easier for yourself.



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Heating of Airplanes Explained

LOS ANGELES—"The Heating and Ventilating of Airplanes" was the subject of a talk delivered at the March meeting of the local chapter of the ASHVE, by A. E. Smith, engineer in the heating and ventilating department of the Lockheed Aircraft Corp., Burbank, Calif. Mr. Smith's talk dealt largely with heating and ventilating as it applies to stratosphere airliners engaged in passenger service by airlines operating on transcontinental runs. Governed by Federal restrictions applying to airplane plants working on national defense contracts, the speaker dealt largely in general statements.

He touched upon the subject of heat-exchange boilers now used to a considerable extent for heating planes, explaining that a small and compact boiler, measuring some six by fourteen inches has been found practical. He discussed briefly, also, various new types of metals and alloys that have been developed for use in airplane compressors and heat-exchange boilers that have made it possible to keep down the weight of such units.

Gilmour Host to Contractors

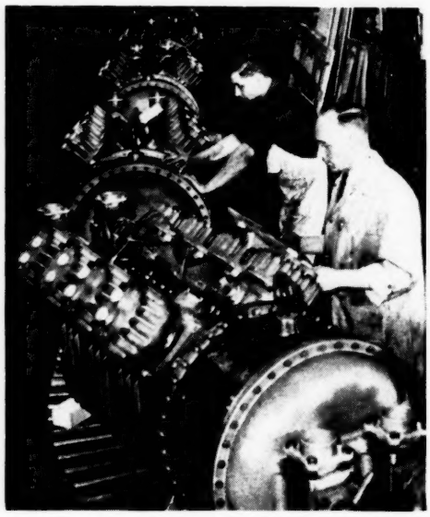
NEW YORK—More than 500 heating and oil-burner contractors as well as industrial plant operating and design men and consulting engineers of the Brooklyn, N. Y., area, were guests of the B. F. Gilmour Company February 25.

Principal speaker at the meeting was George Dandrow, manager of the Johns-Manville power products and industrial department in the New York district. Mr. Dandrow outlined facts about insulation and refractories, as well as packings and other industrial materials. He discussed some do's and don'ts in the use of such materials, and answered numerous questions put to him by the lively audience. The J-M sound motion picture, "Heat and Its Control" was shown.

Bryant Gilmour, treasurer of the nationally known supply house, conducted the meeting and acted as master of ceremonies for the entertainment which followed.

Heating Modernizing Loans Up

WASHINGTON—A total of $276,000,000 of loans was insured by FHA during 1940 for property improvement and modernization purposes. The largest single modernization item covered by these loans was for $66,315,389 (189,259 loans) which was for heating equipment and installations. In percentage of the total this was 28.7% of the total number and 24% of the total amount as compared with 24.7% of the number and 20.1% of the amount in 1939.



COOL AIR FOR BLACKOUT PLANTS

Compact air conditioning compressors will provide cool air for workers in two defense blackout plants. Built at the Westinghouse plant in Springfield, Mass., units are being checked out for shipment to the U. S. shell factory in Gadsden, Ala., and Douglas Aircraft plant in Long Beach, Calif.

N. J. Factory Building Sets Record

TRENTON—New Jersey factory construction reached another record mark in February, according to state labor department statistics announced by State Labor Commissioner John J. Toohey, Jr. During the month 143 plans calling for a total expenditure of $3,087,598 were approved.

Both number and valuations are four times the average for February in the last 22 years. During February, 1940, the labor department approved 78 plans for expenditure of $962,660.

Soldiers Taught to Fire Furnaces

CAMP EDWARDS, MASS.—The U. S. Army is providing experts and still more experts to instruct the buck private in ways of doing things. The latest, to ensure proper heat in the barracks, is Allen Bearse, heating engineer of Anthracite Industries, who is giving instruction in the operation of barracks furnaces to the utility and furnace men of each regiment.

Fan Manufacturers Elect Wendt

DETROIT—The National Association of Fan Manufacturers, at its annual meeting here February 20, elected Edgar F. Wendt, president; E. Szekely, vice-president; and L. O. Monroe, secretary-treasurer for the ensuing year.

Mr. Wendt is president of Buffalo Forge Company. Mr. Szekely is vice-president and general manager of Bayley Blower Company.

Trailers Bought for Defense Housing

WASHINGTON — Somewhat over three and a half million dollars has been allocated to the Farm Security Administration for the purchase of 2000 trailers to house that many family groups and for use as dormitories for unmarried men near defense projects.

Nearly one and a half million dollars has been allocated to the Maritime Commission to fit out old ships to be used as boarding houses near defense projects or camps.

5164 Hp. in A.C for Studebaker

CHICAGO—Twenty-one central air conditioning plants, totaling 5164 hp., were sold during the month of February in Chicago according to the air conditioning division of the Commonwealth Edison Company. The largest single installation sold was that for the Studebaker Aircraft Engine plant which called for 3750 tons.

1939 Census of Manufactures

WASHINGTON — Preliminary data on the production of various items of heating and air conditioning equipment were recently released by the Census of Manufactures of the Department of Commerce. Some of the information from this Census is summarized in the accompanying table.

Further information on this Census is available from Frank R. Wilson, Chief, Division of Public Relations, U. S. Department of Commerce, Bureau of the Census, Washington, D. C.

PRELIMINARY DATA ON EQUIPMENT PRODUCTION, CENSUS OF MANUFACTURES, 1939

EQUIPMENT	1939		1937	
	No.	VALUE	No.	VALUE
Unit heaters	67,782	$4,720,713	56,847	$5,863,376
Unit heaters, number not reported	—	2,553,190	—	1,331,139
Stokers, residential	95,754	10,649,580	86,045	11,922,250
Stokers, residential, number not reported	—	1,001,919	—	85,043
Pipe and boiler insulation, lb.	2,680,161	365,991	—	—
Oil burners, domestic	184,956	13,072,492	181,242	16,904,500
Air conditioning units	34,738	5,993,739	—	—
Air conditioning units, number not reported	—	2,277,453	—	—
Comfort systems for a.c.	1,785	3,713,414	—	—
Condensing units for a.c.	4,360	2,635,774	—	—
Evaporators for a.c.	7,997	1,601,607	—	—
Evaporators, number not reported	—	260,798	—	—
Electric convector heaters	194,877	511,837	179,368	671,023
Electric radiant heaters	330,088	546,632	303,581	529,53[illegible]

CAN YOU SMELL A PROFIT?

You can if you are aware of the possibilities of odor control. Scientific *control* of odors — not merely dilution or masking — is as much a part of air conditioning as are blowers, filters or humidifiers. And Dorex Odor *Ad*sorbers, working on the gas mask principle and employing specially processed, highly activated coconut shell carbon, offer the *one positive method of odor control.*

Air drawn through Dorex Odor *Ad*sorbers is rendered odor-free and more air can be re-circulated, permitting a reduction in the outdoor air supply. Such a reduction (actually from 12 to 25 CFM per occupant) means a dollars and cents saving.

Dorex Odor *Ad*sorbers offer you additional and easily earned profits on the initial installation—also assurance of more efficient operation of the air conditioning equipment you recommend, and customer satisfaction.

Remember—thermal air conditioning is only the beginning—odors too must be controlled, for employee health and the success of business itself are at stake. If you ever expected to smell a profit—this is it!

"WORKS LIKE A GAS MASK"

DOREX

Reg. U. S. Pat. Off.

ODOR ADSORBERS

THERE IS A SPECIAL DOREX unit for almost every industrial or commercial odor problem, and smaller sizes for independent use—

HOSPITALS OFFICES FACTORIES RESTAURANTS THEATERS HOMES STORES COLD STORAGE COMPANIES LABORATORIES LOCKER PLANTS

Bulletin V-4, *What Dorex Odor Adsorbers Mean to Air Conditioning,* brief and concise, contains facts and figures. From it you can determine almost at a glance just how much Dorex will save on any given job, regardless of size. Write for your copy today.

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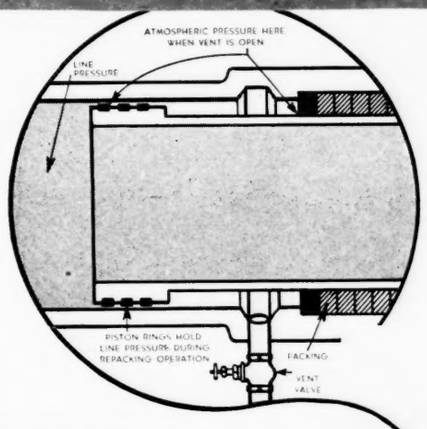
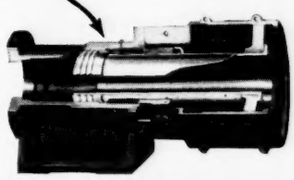
FOR ODOR-CONTROL, AIR CONDITIONING AND VENTILATION

ADSCO PISTON-RING EXPANSION JOINT

Can be REPACKED UNDER PRESSURE without Service Interruption


ATMOSPHERIC PRESSURE HERE WHEN VENT IS OPEN
LINE PRESSURE
PISTON RINGS HOLD LINE PRESSURE DURING REPACKING OPERATION
PACKING
VENT VALVE



Piston rings hold the line pressure when the vent chamber is opened to atmosphere, thereby relieving the stuffing box of all pressure, permitting the complete removal of all packing without shutting off steam.

The ONLY Slip Type Joint which can be UNPACKED UNDER PRESSURE

This exclusive piston ring feature enables you to remove ALL the packing and insert a complete set of NEW packing rings without interruption to service when infrequently necessary to repack this joint.

This is but the latest of many ADSCO inprovements in slip type expansion joints during the past 60 years.

Equally important for dependable joint operation are these ADSCO features—correctly proportioned stuffing boxes; polished slips of time-tested material for ease of movement; positive limit stops prevent overtravel of slip; practical internal and external guides for proper alignment and pressure fittings for replacing lubricant in the packing, thereby keeping it pliable and prolonging its life.

You get all of these features in ADSCO Slip Type Expansion Joints at no price premium over comparable types of joints.

Write for ADSCO Catalog No. 35V.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

NEW EQUIPMENT

Goodrich Exhaust Hose

NAME—Goodrich exhaust hose.
PURPOSE—Specially constructed exhaust hose for conducting fumes and abrasive dust.
FEATURES—Said to be light and flexible and easily bent at short angles so that it may be located at the spot where fumes or dust originate. Made of smooth rubber tube, helical wire reinforced, plies of fabric and corrugated rubber cover.
SIZES AND CAPACITIES—From 2 to 12 in. in diameter, in either 15 or 25 ft. lengths.
MADE BY—*The B. F. Goodrich Co., Akron, Ohio.*

Insulmat No. 595

NAME—Insulmat No. 595.
PURPOSE—A spray-on plastic compound to eliminate condensation drip.
FEATURES—Compound contains specially treated cork particles. Requires no priming, adhesive or supports and can be applied to any material.
LITERATURE AVAILABLE—Circular.
MADE BY—*J. W. Mortell Company, Kankakee, Ill.*

York Condensing Units

One of the line of York condensing units.

NAME—Freon-12 refrigerating units.
FEATURES—New line of York self-contained refrigerating units varies in size from 1/5 to ½ hp.; the smallest unit 12⅜ in. high, 20 in. long, 15 1/16 in. wide; weighs 102 lb. Extra compact model is used in company's own self-contained packaged units. Comes in three sizes—1/5, ¼, and 1/3 hp., all air cooled. Model for remote location, outside the cabinet or cooling space, has fan and belt guards, rubber-cushioned legs, in following sizes: 1/5, ¼, 1/3 and ½ hp., air cooled; and ½ hp. water cooled. All, with exception of 1/5 hp. size, are supplied for three different operating speeds, depending on whether high, medium, or low suction-pressure operating conditions are desired.
MADE BY—*York Ice Machinery Corporation, York, Pa.*

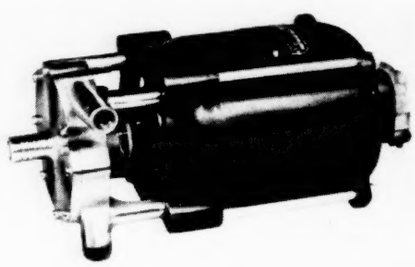
Cubes of Caloride.

Caloride

NAME—Caloride.
PURPOSE—For drying air or gases.
FEATURES—Substance is a specially-designed, patented form of moisture-absorbing chemical developed to dry air and gases. It is in the form of hard, fused solid blocks approximately 1½ x 1½ x 2 in. Upon exposure to air or gas, outside surfaces of cubes absorb moisture and the cubes gradually diminish in size as brine is formed. Cubes retain their shape until entirely dissolved. A bed of these will not fuse into a solid mass, permitting continuous circulation of air or gas through a chamber filled with the cubes. Available in two types: Caloride O is used as a moisture-absorbing agent only; Caloride A, in addition to absorbing moisture, contains an odor-absorbing carbon for reducing odor. Available in steel drums containing 325 lb. of cubes.
MADE BY—*Solvay Sales Corporation, 40 Rector St., New York, N. Y.*

Small Explosion Proof Pump

NAME—Eastern model D explosion proof pump.
PURPOSE—For industrial, pilot plant, laboratory or experimental applications.
FEATURES—A midget size unit 10 in. long, 5½ in. high and 5 in. wide with a maximum pressure of 16 lb. per sq. in. and maximum capacity of 5.7 g.p.m.
MADE BY—*Eastern Engineering Company, 45 Fox St., New Haven, Conn.*



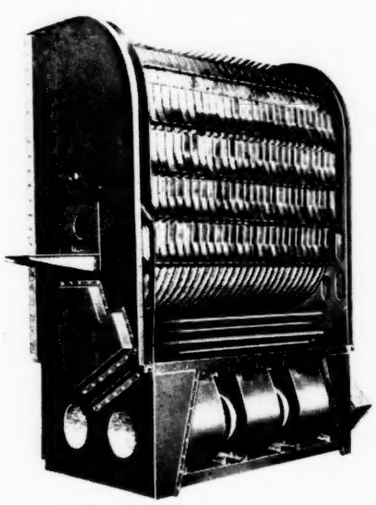
Midget explosion proof pump.

Heat-Rite Register

NAME—"Heat-Rite" Register.
PURPOSE—For use with gravity furnaces.
FEATURES—Of the fin type, stream line, made in one and two piece models with slightly downward directional fins. Intended for modernizing as well as new installations. Finished in the company's new DuraTone finish.
SIZES AND CAPACITIES—A full range of sizes for both baseboard and wall applications, and intakes for baseboard.
LITERATURE AVAILABLE—Descriptive folder.
MADE BY—*The Auer Register Company, Cleveland, Ohio.*

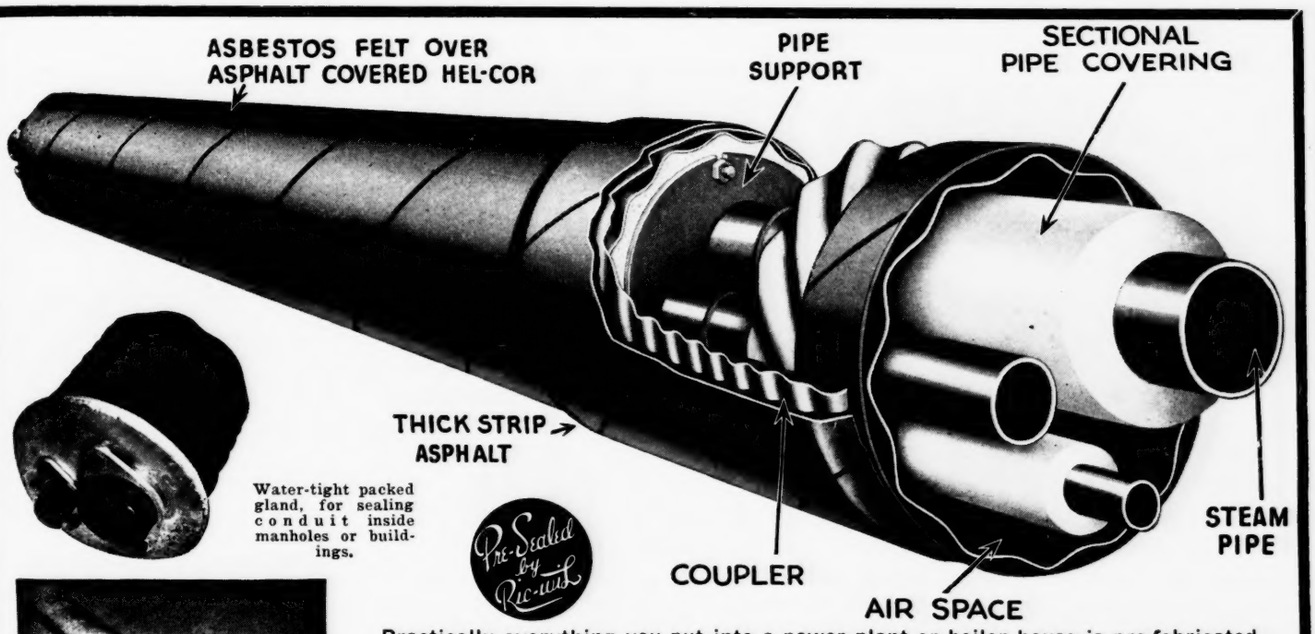
Dravo Direct-Fired Heater

NAME—Dravo direct-fired heater.
PURPOSE—For large industrial applications.
FEATURES—A 1,500,000 B.t.u. per hr. unit to be fired with either oil or gas and with many of the features of the 1,000,000 B.t.u. per hr. unit made by



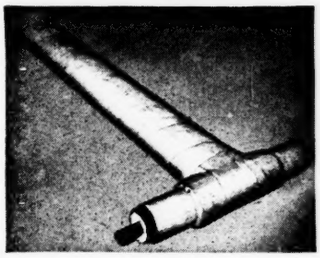
Large capacity Dravo heater.

the same company. A new feature includes tubular economizer. Unit is of steel construction throughout with welded steel plate combustion chamber heavily corrugated with large steel fin surface welded to it. Fans are located below heater which is of blow-through type. Combustion chamber is jacketed by air at high velocity and thus requires no insulation. Can be converted from oil to gas or vice versa at any time. Fan capacity, referred to intake conditions, is 18,000 c.f.m. Available with controls and adjustable discharge nozzles on the top. Can also be used in connection with a duct system.
MADE BY—*Dravo Corporation, Neville Island Branch, Pittsburgh, Pa.*



Water-tight packed gland, for sealing conduit inside manholes or buildings.

Pre-Sealed by Ric-wiL



Pre-fabricated Hair-pin type expansion loop for small size pipes, for 3" to 6" expansion (Type "U" expansion loop is furnished for larger size pipes).

Practically everything you put into a power plant or boiler house is pre-fabricated. Why not underground piping? For the underground distribution of steam, hot water, or oil, these pre-sealed Units built on a strong, pure iron shell of Armco Hel-Cor, and protected with thick asphalt of special quality, provide the most modern and durable construction. Every piece engineered for its purpose—resulting in utmost speed and perfection on the job. Fully assembled Units, complete with pre-built fittings as necessary, are factory tested, and come to the job ready to be joined by split connector method or by welding. For speed on delivery and installation—get in touch with Ric-wiL.

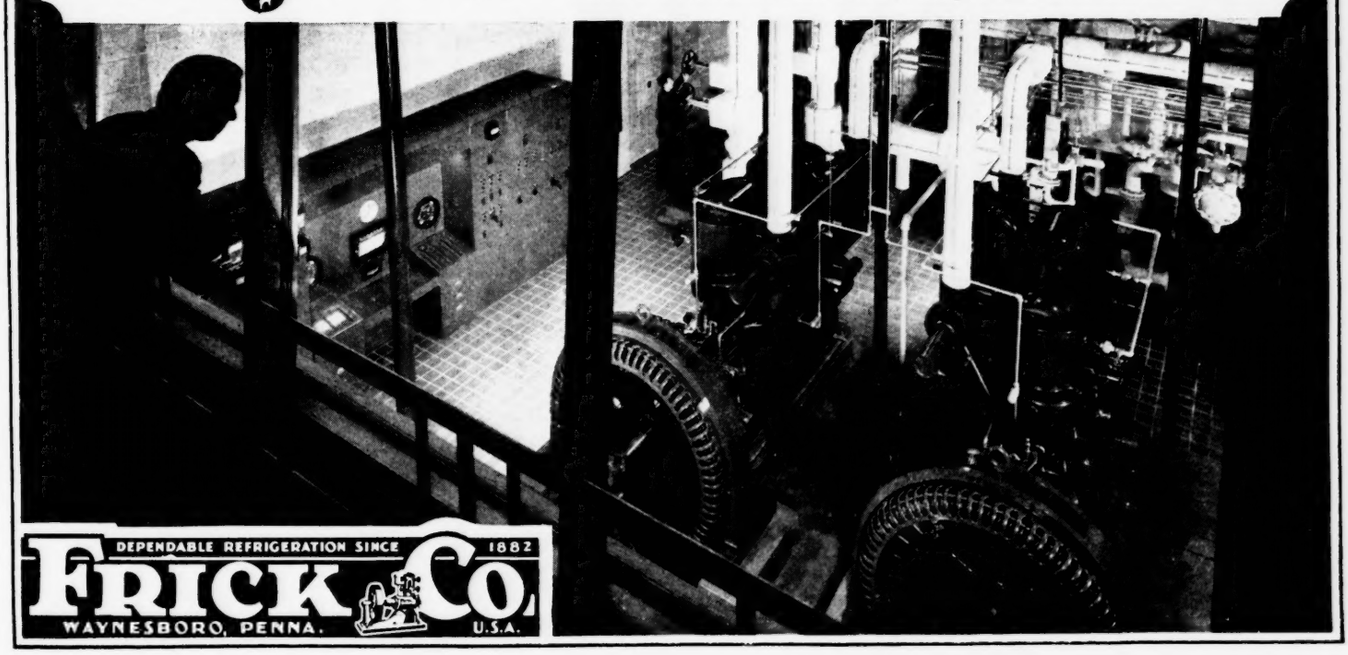
The Ric-wiL Co., Cleveland, Ohio *Agents in principal cities*

RIC-WIL PRE-SEALED INSULATED PIPE UNITS

TRADE FRICK MARK

Refrigeration

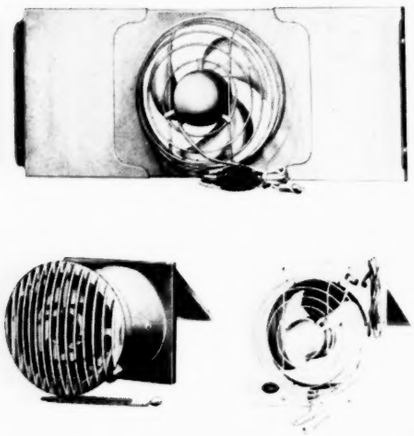
wins the preference of engineers, architects and owners alike on important work—whether air conditioning, cooling drinking water, food service, making ice, dispensing beverages, cold storage, quick-freezing, or any other cooling work. Photo shows two of the three Frick Freon-12 machines at the Bankers Life Building, in Des Moines. If you want to be proud of your cooling equipment, specify Frick Refrigeration. For estimates write FRICK COMPANY, Waynesboro, Penna.



DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.



Ilg kitchen fans. Above, portable type; below, left, built-in type; right, package type.

Ilgvent Kitchen Fans

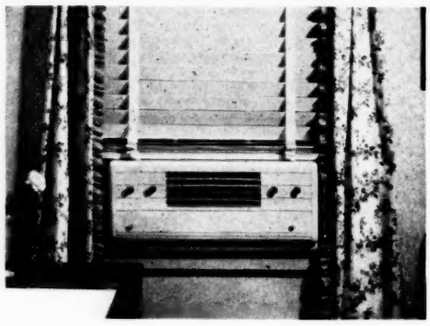
NAME—Ilgvent ventilating fans.
PURPOSE—Low-cost fans for ventilation of kitchen, bathroom and rumpus room.
FEATURES—Available in three types—built-in, portable, and package type. Built-in model is of telescopic type, 16-gauge rust-resisting steel cabinet, with standard sleeve to fit wall from 8½ to 13 in.; units to fit walls of 5¾ to 8½ in., 13 to 22 in. and 22 to 31 in. also available. One-piece door on outside of building is weather-proofed, can be opened or closed by a beaded pull chain, simultaneously causing fan motor to start or stop. Motor is neoprene mounted with lubricated-for-life bearings. Fan wheel electrically tested for dynamic balance. Grille is of polished aluminum. Portable model intended for rented homes or apartments. Package type model is intended for window-pane installation.
SIZES AND CAPACITIES—Eleven sizes and models.
MADE BY—*Ilg Electric Ventilating Company, 2850 N. Crawford Ave., Chicago, Ill.*

Utica 3 Boiler

NAME—Utica 3 boiler.
PURPOSE—House heating boiler for hand or automatic firing.
FEATURES—Cast iron boiler with jacket in silvery blue and doors in cobalt blue wrinkle finish; door handles are Mandarin red, gauge is chrome. Base sides have removable plates, if stoker installation is desired, or removable back plate if oil heat is preferred. Boiler sections are finned. Trombone heater supplied in hot water boiler and external heater in steam boiler for domestic water supply.
SIZES AND CAPACITIES—Available in 4 models of either steam or water types with capacities ranging from 450 to 780 sq. ft. of steam and from 720 to 1245 sq. ft. of water surface.
MADE BY—*Utica Radiator Corporation, Utica, N. Y.*

Filteraire Unit

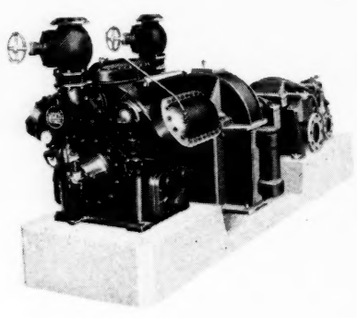
NAME—1941 model Filteraire unit.
PURPOSE—A window type unit for window ventilation.
FEATURES—Volume of air delivery has been increased over previous model from 500 to 600 c.f.m. and the appearance of the unit has been changed by complete redesigning by an industrial designer.
SIZES AND CAPACITIES—Two models, B-5 and B-3, with dimensions of 30x14x11½ in. and 26¼x12x11½ in., respectively.
MADE BY—*Davies Air Filter Corp., 118 East 25th St., New York, N. Y.*



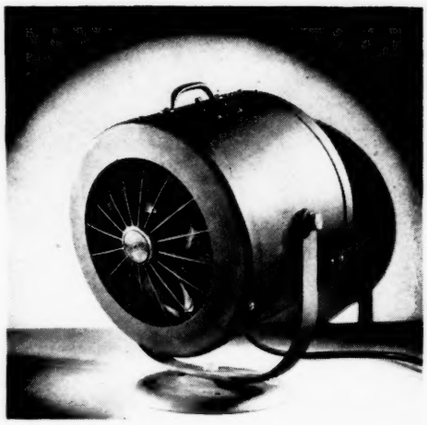
1941 model Filteraire.

York Ammonia Compressor

NAME—York V/W ammonia compressor.
PURPOSE—For industrial refrigeration.
FEATURES—Principal difference between this machine and company's Freon-12 ammonia compressor is its water jacketed heads due to higher head temperatures. All features in the Freon compressor have been retained in the ammonia machine. Heavy foundations have been eliminated, wearing parts are replaceable. Packless, springless balanseal and double tapered roller bearings are used. Low head room and little floor space are required. Its high speeds permitted to be virtually connected to a steam turbine through a simple gear drive.
MADE BY—*York Ice Machinery Corporation, York, Pa.*



York V/W ammonia compressor.



Electric unit heater.

Westinghouse Electric Unit Heater

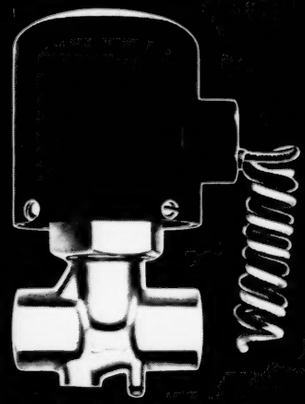
NAME—Westinghouse electric unit heater.
PURPOSE—Year-round use in offices and stores.
FEATURES—A fan-type all electric unit heater, cylindrical in shape, with a swivel bracket for vertical and horizontal adjustment. Has a Westinghouse Corox heating element. The switch for winter operation controls both heating element and fan; bimetal thermostat removes both motor and heater from the line in case of overheating. Fan operates independently for summer use.
SIZES AND CAPACITIES—Available in 2, 3 and 4 kw. sizes at 115 and 230 volts, a.c., with outputs of 7000, 10,000 and 14,000 B.t.u. per hour, respectively. Overall dimensions are 16¼ x 13¾ x 11½ in.
LITERATURE AVAILABLE—From the company's Department 7-N-20.
MADE BY—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Standard Computing Scale Company Air Conditioning Unit

NAME—Dew-Aire conditioning unit.
PURPOSE—For year-round air conditioning.
FEATURES—Unit is designed for use in connection with either steam or hot water systems and is said to heat, clean, humidify, and circulate air during the winter, and during the summer, clean and circulate the air. When water is available at 60F or lower the unit is said to develop 1½ to 2 tons of cooling or it can be used with a condensing unit to develop up to 5 tons of cooling. Unit is available in three modern designs, full grain walnut, dark red mahogany and Swedish modernistic.
MADE BY—*Air Conditioning and Refrigeration Division, The Standard Computing Scale Company, Inc., Detroit, Mich.*

DEPENDABLE

More than 1/3 of the A-P Payroll is Devoted to TESTING!



A-P Model 73-RJ
Solenoid Refrigerant
Valve

★ Progressive Service Engineers use and recommend — and Aggressive Jobbers stock and talk... A-P Products

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2462 NORTH THIRTY — SECOND STREET
MILWAUKEE WISCONSIN

Export Department 100 Varick Street, New York City

CALORIDE
TRADE MARK REG. U. S. PAT. OFF.

FOR DRYING AIR OR GASES

WHAT "CALORIDE" IS—"Caloride" is an especially designed, patented form of moisture absorbing chemical produced in the shape of hard, fused solid blocks as shown above.

WHAT IT DOES—Upon exposure to air, "Caloride" cubes attract moisture, gradually diminishing in size as moisture is absorbed. Due to their patented features, "Caloride" cubes retain their form until they are entirely dissolved—thus permitting free and continuous circulation of moisture laden air or gas through a suitable container filled with cubes.

WHERE USED—"Caloride" is used wherever there is a need for control of excessive humidity. "Caloride" prevents condensation and ends mold, mildew and other damage caused by excessive moisture in air. Its use is not restricted to any particular size or type of equipment—it is being used in commercial units handling large volumes of air as well as in small equipment designed for more limited application.

SEND FOR DETAILS

SOLVAY SALES CORPORATION
40 Rector Street, New York, N. Y.

Please send complete details on "Caloride"—including prices, packages, new folder "Caloride For Drying Air or Gases."

Name.....

Affiliated with.....

Address.....

City..... *State*..... 85-441

Reducing elbow for welding.

Midwest Reducing Welding Elbows

NAME—Midwest reducing butt-welding elbows.
PURPOSE—In a welded pipe line where it is necessary to change both direction and pipe size this elbow will take the place of both a straight elbow and a straight reducer thus reducing cost of fittings, elimination of one or two welds, improved appearance and saving in time.
FEATURES—Have dimensional accuracy and uniformity of other fittings in company's line. Metal has been worked in compression and not extruded or stretched. After forming, elbows are stress relieved.
SIZES AND CAPACITIES—Available in 33 sizes ranging from 2x1½ in. to 12x6 in.
LITERATURE AVAILABLE—Bulletin WF-41.
MADE BY—*Midwest Piping & Supply Company, Inc., 1450 S. Second Street, St. Louis, Mo.*

Crane Series 14 Boiler

NAME—Crane series 14 boiler.
PURPOSE — A cast iron boiler available in steam or hot water and built in unusually small sizes to meet the demand for a boiler for small homes.
FEATURES—Boiler has a wet base which can be placed on wood floor with safety due to insulating effect of water jacket under combustion chamber. Available with either steam or hot water and can be used with gravity hot water in house without basement because of the low return port. Boiler permits use of internal water heater. For manual or automatic firing. Manufacturer states IBR ratings are comfortably developed. Boiler shipped with section assembled.
SIZES AND CAPACITIES — Boiler measures 21½ in. in width, with variable depth ranging from 15⅜ in. to 27⅜ in.
MADE BY—*Crane Co., 836 South Michigan Ave., Chicago, Ill.*

Jenkins Swing Check Valve

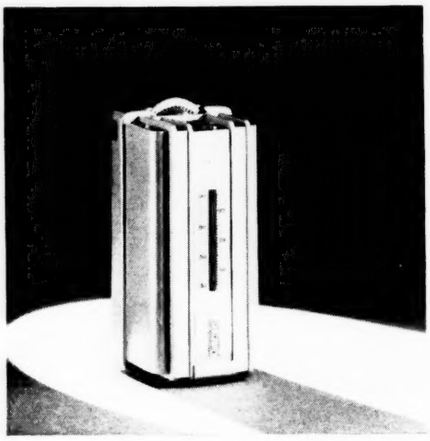
NAME—Jenkins check valve, Fig. 92.
PURPOSE—A regrinding swing check valve for 125 lb. steam pressure at 500F or 250 lb. non-shock cold oil, water or gas.
FEATURES—Permits full flow and is particularly suited for condensate and return lines as well as for feed and oil line service. Disc can be reground without removing valve from the line.
SIZES AND CAPACITIES—¼ to 2 in.
MADE BY—*Jenkins Bros., 80 White St., New York, N. Y.*

Emerson Air Circulator

NAME—Emerson air circulators.
PURPOSE — Floor type fans for commercial and industrial application.
FEATURES—Includes complete line of 24 and 30 in. size in a.c. and d.c., each available in four styles of mounting accessories: floor column, counter column, ceiling and wall bracket. Streamlined appearance. Finished in combination of polished aluminum and chromium. Fan has three large aluminum blades, grease-packed ball bearings that require relubrication every 6000 hours. Two-speed operation. The 30 in. fan delivers 8600 and the 24 in. fan delivers 6100 cu. ft. of air per minute, standard NEMA test method 4 ft. from fan on high speed.
MADE BY — *The Emerson Electric Manufacturing Company, St. Louis, Mo.*

Perfex Unit Heater Control

NAME—Perfex 200-D14 thermostat.
PURPOSE—Addition to the Twin Contact line of controls; specifically designed for unit heater control.
FEATURES—May be set to control any temperature from 40 to 80F. For ventilating purposes an "on" position beyond the 80F mark produces continuous fan operation. Safety latch prevents accidental turning of temperature dial to the "on" position. Special bellows thermal element, operating through spring-hinge linkage opens and closes electrical circuit.
MADE BY—*Perfex Corporation, Milwaukee, Wis.*



Perfex 200-D14 control.

Spray nozzle with wide angle spray.

Wide Angle Spray Nozzle

NAME—Parasol wide angle atomizing spray nozzle.
PURPOSE—For spraying inside of cylindrical objects or wherever an exceptionally wide angle is desired.
FEATURES—Spray is hollow cone type with uniform distribution and wide spray angle. Nozzles are accurately machined with polished orifice insert, with or without strainer. Standard construction is brass with 18-8 stainless steel inserts but other materials can be specified.
SIZES AND CAPACITIES—In male or female ¼ in. pipe connection. Capacities range from 4 to 16 gal. per hr. at 60 lb. pressure.
MADE BY — *Spraying Systems Co., 4021 W. Lake St., Chicago, Ill.*

Moisturator

NAME—Moisturator.
PURPOSE—Humidifier for homes, offices, and other buildings.
FEATURES — Device consists of an evaporator in which steam passes through tubes surrounded by a thin film of water automatically supplied through a ¼ in. copper tube from the water line in the basement. Steam is supplied by radiator supply pipe which is broken at the floor line to accommodate introduction of the device. If desired, water can be supplied from radiator condensate which is filtered through carbon to remove odors. Can be installed directly under the radiator near the floor or underneath the floor in which case opening is provided to radiator space. When used with hot water system, heater is introduced into firebox of boiler and connected to the Moisturator; with a warm air system, the heater is introduced into the combustion chamber and the Moisturator is located in the furnace bonnet.
LITERATURE AVAILABLE — Four-page standard size folder entitled "Warco Moisturator Stops Dry Air."
MADE BY—*W. A. Russell & Co., Bridgeport, Conn.*

In BANKS—*wherever* QUIET *is essential*

use **Careyduct** THE ALL-ASBESTOS INSULATED DUCT

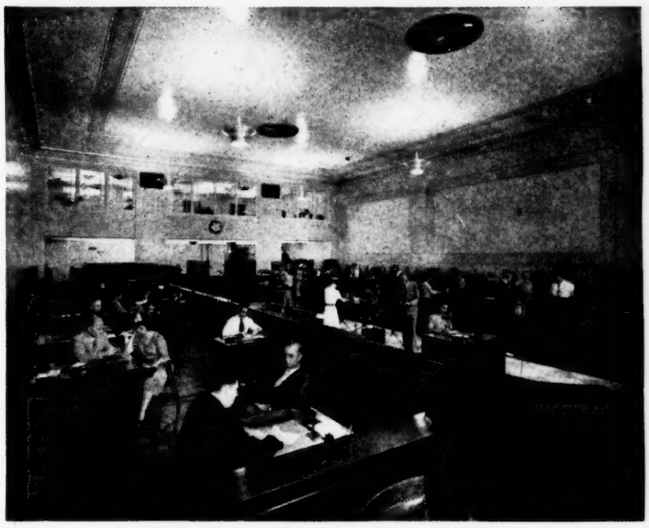
for **AIR-CONDITIONING SYSTEMS**

CAREYDUCT is made entirely of asbestos—combines both duct and insulation. Simple slip-joint construction and standardized parts make fitting on job easy and rapid. Cuts easily with saw; no shop work necessary.

CAREYDUCT "hushes" fan noises; reduces "speaking tube" effects. Air velocities may be increased without noise, enabling you to use smaller sizes — a saving in both materials cost and labor.

CAREYDUCT is fireproof; can't rust or rot. Makes a smoother, better-looking, more efficient job. Size for size, it costs LESS than insulated metal duct.

Bring your duct work up-to-date — keep customers satisfied — make more money — with CAREYDUCT. Write today for full details—address Dept. 49.



Guardian Bank, Cincinnati, Ohio.

Through the use of CAREYDUCT in this bank's air-conditioning system, all of the duct work was erected in the furred space above the ceiling during banking hours and without disturbing banking operations.

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

Type 513 Single Speed Fan Control. Range 100° to 300° Fahrenheit.

See for Yourself

how easily you can install White-Rodgers Hydraulic-Action fan and limit controls. Positive, accurate performance assured, regardless of position. Easy-to-read dials permit exact setting of cut-in and cut-out temperatures. Write for White-Rodgers Control Catalog today!

WHITE-RODGERS ELECTRIC CO.

1207 CASS AVE. • ST. LOUIS, MO.

THE WISE CONTRACTOR USES

INTEGRAL FIN
REMOVABLE COPPER TUBE
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MAXIMUM EFFICIENCY AT LOW COST
UP TO 500 TONS CAPACITY

For exact selection Engineering Data
Write for Catalogs Nos. 23 and 24

ACME INDUSTRIES
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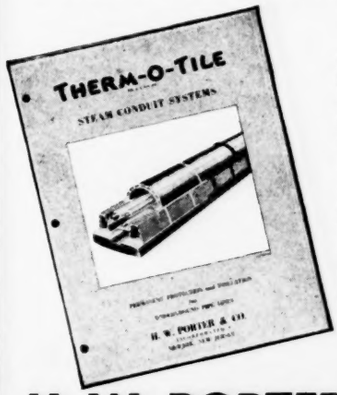
Ask for this Bulletin about

THERM-O-TILE

Reg. U. S. Pat. Off.

The Simplest, Strongest, and Most Efficient Conduit for Underground Pipe Lines



Monolithic concrete base. No broken stone fill. Strong arched construction. No bell joints. Internal channel drain. Etc. There are ten other outstanding reasons why Therm-O-Tile is the superior conduit system. Treated fully in Bulletin 381, shown at the left.

Therm-O-Tile is sold and installed by Johns-Manville Construction Units in all Principal Cities.

See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.

823-V Frelinghuysen Ave., Newark, N. J.

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Name.....

Firm.....

Street.....

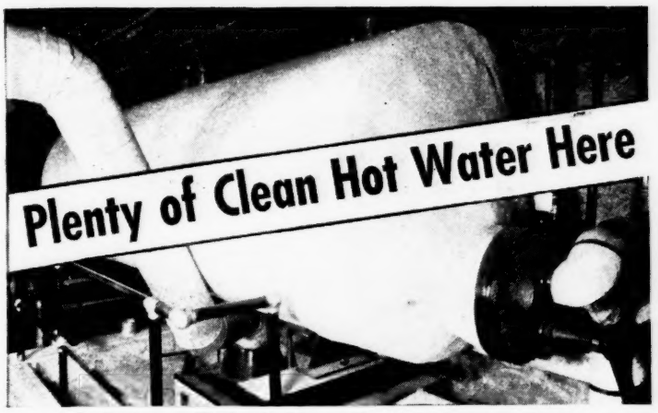
City.....State.....

Number of Degree-Days for February, 1941

HEATING & VENTILATING continues its thirteenth year of publishing degree-day data for various large cities. Forty-four cities have been added to the list of those previously published. A total of 116 cities are listed below.

	Degree-Days Feb., 1940	Degree-Days Feb., 1941	Deg. Days Cumulative, 1941
Albany, N. Y.	1248	1166	5313
Alpena, Mich.	—	1244	5425
Atlanta, Ga.	663	709	2405
Atlantic City, N. J.	—	919	3533
Baker, Ore.	—	836	4488
Baltimore, Md.	798	866	3334
Binghamton, N. Y.	—	1169	4990
Birmingham, Ala.	611	633	2071
Bismarck, N. D.	—	1389	6212
Boise, Idaho	—	715	3985
Boston, Mass.	1029	998	4404
Buffalo, N. Y.	1163	1157	4824
Burlington, Vt.	1387	1244	5864
Cairo, Ill.	—	829	2981
Canton, N. Y.	—	1303	6080
Charles City, Iowa	—	1348	5455
Charlotte, N. C.	—	700	2504
Chattanooga, Tenn.	—	761	2876
Cheyenne, Wyo.	1045	919	4647
Chicago, Ill.	1038	1104	4369
Cincinnati, Ohio	928	968	3668
Cleveland, Ohio	1058	1076	4212
Columbia, Mo.	—	918	3614
Columbus, Ohio	964	1016	3927
Concord, N. H.	—	1113	5232
Concordia, Kan.	—	984	4052
Davenport, Iowa	—	1155	4442
Dayton, Ohio	—	1033	4012
Denver, Colo.	853	778	3811
Des Moines, Iowa	1152	1137	4575
Detroit, Mich.	1110	1111	4679
Dodge City, Kan.	858	853	3549
Dubuque, Iowa	—	1198	4839
Duluth, Minn.	1346	1419	6319
Eastport, Me.	—	1108	5496
Elkins, W. Va.	—	1096	4192
El Paso, Tex.	420	333	1832
Erie, Pa.	1102	1102	4403
Escanaba, Mich.	—	1243	5585
Evansville, Ind.	858	935	3496
Fort Smith, Ark.	—	668	2463
Fort Wayne, Ind.	1057	1114	4461
Fort Worth, Tex.	506	515	1916
Fresno, Calif.	—	—	—
Grand Rapids, Mich.	1098	1131	4695
Green Bay, Wis.	1230	1284	5445
Greensboro, N. C.	—	811	3083
Harrisburg, Pa.	950	991	4101
Hartford, Conn.	1080	1036	4710
Helena, Mont.	—	1040	5380
Huron, S. D.	—	1345	5616
Indianapolis, Ind.	950	1033	3892
Ithaca, N. Y.	1154	1158	4961
Kansas City, Mo.	937	931	3669
Keokuk, Iowa	—	1036	4048
Knoxville, Tenn.	719	792	2811
La Crosse, Wis.	1188	1295	5338
Lander, Wyo.	—	1107	5564
Lansing, Mich.	1171	1166	5000
Lincoln, Neb.	1130	1055	4351
Little Rock, Ark.	652	671	2320
Los Angeles, Calif.	167	175	680
Louisville, Ky.	861	903	3256
Lynchburg, Va.	—	806	3079
Madison, Wis.	1223	1271	5222
Marquette, Mich.	—	1217	5497
Memphis, Tenn.	686	700	2372
Milwaukee, Wis.	1088	1180	4807
Minneapolis, Minn.	1326	1408	5799
Nantucket, Mass.	—	937	3953
Nashville, Tenn.	733	794	2779
New Haven, Conn.	988	985	4288
New Orleans, La.	338	331	970
New York, N. Y.	930	941	3877
Norfolk, Va.	657	753	2610
Northfield, Vt.	—	1297	6154
North Platte, Neb.	—	974	4390
Oklahoma City, Okla.	709	689	2750
Omaha, Neb.	1162	1085	4487
Oswego, N. Y.	—	1154	4993
Parkersburg, W. Va.	—	972	3672
Peoria, Ill.	1030	1105	4306
Philadelphia, Pa.	877	929	3669
Pittsburgh, Pa.	950	1029	3911
Pocatello, Idaho	—	916	4757
Portland, Me.	1101	1138	4583
Portland, Ore.	515	450	2626
Providence, R. I.	1010	974	4304
Pueblo, Colo.	—	781	3967
Raleigh, N. C.	—	736	2638
Reading, Pa.	927	982	4048
Reno, Nev.	713	648	3555
Richmond, Va.	726	806	3083
Rochester, N. Y.	1170	1189	5027
Roseburg, Ore.	—	476	2549
St. Joseph, Mo.	—	970	3911
St. Louis, Mo.	899	904	3356
Salt Lake City, Utah	746	702	3764
Sandusky, Ohio	—	1066	4316
San Francisco, Calif.	280	269	1292
Sault Ste. Marie, Mich.	—	1307	6023
Scranton, Pa.	1068	1105	4721
Seattle, Wash.	525	469	2551
Sioux City, Iowa	—	—	—
Spokane, Wash.	845	746	4176
Springfield, Ill.	985	1006	3860
Springfield, Mo.	—	870	2742
Syracuse, N.Y.	1179	1212	5109
Tacoma, Wash.	—	529	2832
Terre Haute, Ind.	—	999	3781
Toledo, Ohio	1079	1097	4485
Trenton, N. J.	932	968	3999
Utica, N. Y.	1295	1274	5408
Washington, D. C.	811	871	3360
Wichita, Kan.	875	852	3499
Yakima, Wash.	—	713	3900

(—) Indicates data not available.



Patterson Heater in Mercy Hospital, Scranton, Pa.

The Mercy, like all hospitals, must have abundant clean, pure hot water at all hours of the day and night.

They could not take a chance on heater breakdowns or insufficient hot water. They made certain this condition would never occur by installing a Patterson Indestructo Copper-Lined Hot Water Heater, assuring a trouble-free installation, and more than ample rust-free hot water at all times.

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Normal Pitch

Of seamless, all metal, parallel corrugated, armored construction, in various alloys with renewable type fittings approved for the conveyance of non-solids and non-abrasives in *Aviation, Automotive, Marine, Heating, Air Conditioning, Mining, Power Generation, Plastic and Textile applications* wherein conditions of flexing and expansion between delivering and receiving connections exist. Also available for shielding and exhaust applications.

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METAL HOSE DEPARTMENT
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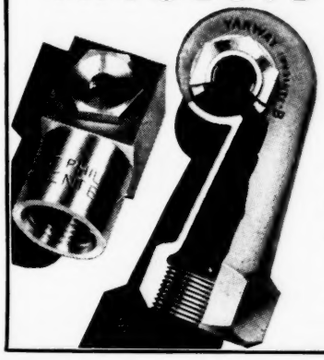

The preference for trouble-free air washing service — because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-615.

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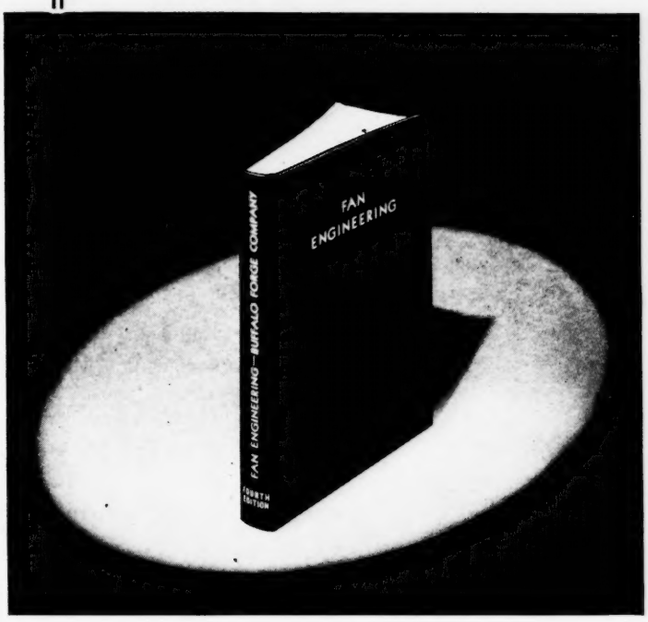

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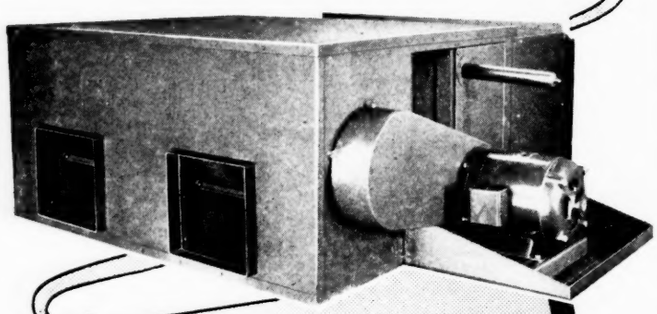

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Refrigerating Equipment Manufacturers

PERSONALS & PERSONNEL

E. K. Sweeney

McQuay, Inc., Minneapolis, Minn, has appointed *E. K. Sweeney* as Philadelphia district manager. Mr. Sweeney for the past four years has been a member of the firm Breitenbach and Sweeney, Trane representatives, and previously was co-manager of The Trane Company's Philadelphia office. For 12 years prior to this he was with the Richardson and Boynton Company.

Williams Oil-O-Matic Heating Corp., Bloomington, Ill., has divided the national market into eastern and western territories under the supervision of regional managers. *E. H. Davison* and *C. C. Kinstler* man the newly established posts. Mr. Davison returns to the organization to fill the post of manager of the eastern regional division after an interval spent in varied activities. Mr. Kinstler will be regional manager of the western division. For the past five years he has been a divisional manager and previous to that was a district representative in the New England territory.

Enterprise Engine & Foundry Company, San Francisco, Calif., has appointed *B. Stockfleth* as assistant to the president, *C. G. Cox* as vice president in charge of sales, and *C. M. Sayre* as vice president in charge of production. Mr. Stockfleth was formerly with the Soule Steel Co., San Francisco. Mr. Cox has been with Enterprise since 1934 while Mr. Sayre joined the company in November, 1940.

Reznor Manufacturing Co., Mercer, Pa., has appointed *John Payton* as district manager for the Indiana and East Central Illinois territory. Mr. Payton's headquarters will be at 1245 West 30th St., Indianapolis.

Francis C. Moran, 315 Grosse Pointe Blvd., Detroit, has been appointed district manager for Southern Michigan and Northwestern Ohio by *Reznor Mfg. Co.*, Mercer, Pa. *Chester McClintock*, Milan, Tenn., has been appointed district manager for the Tennessee territory by the company.

Jas. P. Marsh Corporation, Chicago, has appointed *R. G. Dinham* as their representative in the Minneapolis territory. Mr. Dinham succeeds the partnership operated by *Mr. R. B. Mosher* and himself under the name of Heating Equipment Company, which has now been dissolved.

John E. Fearon, until March 1 in charge of the flow meter sales section of the appliance division, Cochrane Corporation, Philadelphia, has joined the *Boiler Equipment Service Company*, Atlanta. He will be a member of the firm.

Tom H. Pike, Jr., West Coast district manager for *Tube-Turns, Inc.*, Louisville, has established permanent offices in Los Angeles, at 210 West Seventh Street. The West Coast and territory inland as far as Salt Lake City will be serviced from the new Los Angeles office.

C. A. Dunham Co., Chicago, has appointed *F. L. Gallagher* as representative in the Manchester, N. H., area. Mr. Gallagher will have his headquarters at 45 Forest St., Manchester.

WITH THE MANUFACTURERS

The Mercoid Corporation has established new headquarters for its New York office in room 1307, 393 Seventh Avenue, New York. Telephone, BRyant 9-0336.

Research Products Corporation, Madison, Wis., has now completed and now has in operation a new plant for its Air Filter Division. The plant is designed along straight line production plans and is necessary to provide the additional capacity necessary to keep in step with increased product demand.

Charles Demuth & Sons, Garden City Park, N. Y., have appointed the following representatives; *H. T. Goshon,* 1709 W. Eighth St., Los Angeles, for the Southern California territory; *Refrigerating and Power Specialties Co.,* with offices at: 380 Brannan St., San Francisco; 2309 Fifth Ave., Seattle; 615 S.E. Stark St., Portland, Oregon, and 425 Church St., Salt Lake City, for the Northern California territory and the States of Nevada, Utah, Idaho, Montana, Washington and Oregon.

Ilg Electric Ventilating Co., Chicago, has launched the greatest year 'round ventilation campaign in its history with a colorful, all-telling Time broadside, intended for 30,000 appliance dealers and utility merchandise departments. The broadside tells how the 1941 Ilg campaign will consist of nearly 8,000,000 messages placed in 19 national publications—aiding in developing a $50,000 potential business for the dealer. Illustrations show the modern styling of the 1941 Ilg line. Also included is announcement of the new low-priced Ilgvent, a kitchen ventilating fan priced at $16.50 and up.

NEW TRADE LITERATURE

Air Conditioning. "Twenty-five Years of Air Conditioning, 1914—1940" is the title of a striking and unusual pictorial history of the Carrier Corporation. The book concludes with a forecast on the next 25 years of air conditioning by Dr. Willis H. Carrier. Bound in heavy aluminum stock, size 11 x 9 in., with 42 pages. CARRIER CORPORATION, Syracuse, N. Y.

Insulation. The 1941 edition of the company's Industrial Products Catalog, Form GI-6A, is now available. It is a 52-page, illustrated book with information and recommendations on high and low temperature insulations for industrial needs from —400F to 2500F. Complete data are included on refractory products and castables; specifications on bonded asbestos built-up roofs and insulated roofs; detailed information on corrugated transite for roofing and siding; on industrial friction materials; on transite electrical conduit and Korduct, asbestos ebony and other electrical materials, on transite pressure pipe for industrial and municipal water lines; on transite industrial vent pipe and stacks; and on packings and gaskets. JOHNS-MANVILLE, 22 East 40th Street, New York City.

Fire Brick. A 9 x 12 in. 16-page brochure in green and sepia, with unusually beautiful photographs and showing how fire bricks are manufactured. Published under the title "Modern Fire Brick Manufacture." A. P. Green Fire Brick Co., Mexico, Mo.

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THAT'S JUST THE TYPE OF CONTROLS I'M LOOKING FOR

Mercoid Controls have done such a good job for so many exacting users of controls, that they do not hesitate to pass on the good word.

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Mercoid Fig. 34
RISERTHERM

Send for new Mercoid catalog now available. You will need it for the information it contains.

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Air Conditioning. Containing a complete index of the company's air conditioning, refrigeration and space heating equipment and services, the 16-page 1941 Carrier catalog includes illustrations and descriptions of 55 types of equipment, with reprints of the two revised Carrier psychrometric charts on its back cover. The booklet is divided into three sections, residential, commercial, and industrial. CARRIER CORP., Syracuse, N. Y.

Hot Water Heating. A 20-page booklet, in color, written for the home builder or modernizer. Describes in a non-technical language the features of forced hot water heating with year round domestic hot water supply. Liberally and attractively illustrated. BELL AND GOSSETT COMPANY, Chicago, Ill.

Drying. A folder giving complete information on Caloride cubes for the drying of air or gases. Caloride, a patented form of moisture-absorbing chemical, is produced in two types: type O is used as a moisture-absorbing agent only, and type A is used for absorbing odor as well as moisture. SOLVAY SALES CORPORATION, 40 Rector St., New York, N. Y.

Registers and Grilles. A 48-page standard size catalog, No. 41AC in which the complete line of the company's registers, grilles and back pressure dampers are described and illustrated. Includes dimensional, capacity and price data. THE INDEPENDENT REGISTER CO., 3747 East 93rd St., Cleveland, Ohio.

COMING EVENTS

APRIL 8-10. Sixth Iowa Heating and Air Conditioning Conference, Iowa State College, Ames, Iowa. Further information available from Eugene O. Olson, conference director, Iowa State College.

MAY 8-9. Fourth Annual Lehigh Anthracite Conference, Lehigh University, Bethlehem, Pa.

JUNE 10-13, 1941. The 32nd Annual Meeting of the National District Heating Association. To be held at the William Penn Hotel, Pittsburgh, Pa.

JUNE 16-20, 1941. The Pacific Heating and Air Conditioning Exposition, Exposition Auditorium, San Francisco, Cal. Managed by the International Exposition Company, Grand Central Palace, New York.

JUNE 16-20, 1941. Meeting of the Heating, Piping and Air Conditioning National Association. To be held at St. Francis Hotel, San Francisco, Cal.

JUNE 16-20, 1941. Summer Meeting of the American Society of Heating and Ventilating Engineers. To be held at Palace Hotel, San Francisco, Cal.

JUNE 23-27, 1941. Annual meeting and exhibit of the American Society for Testing Materials. Palmer House, Chicago, Ill. For information, write Society at 260 So. Broad St., Philadelphia, Pa.

OCTOBER 14-17. 70th annual meeting of the American Public Health Association to be held at Convention Hall, Atlantic City, N. J. Headquarters, Hotel Traymore. For information, write to American Public Health Association, 1790 Broadway, New York, N. Y.

H&V'S PHOTOS

Cover—Charles Phelps Cushing, New York, N. Y.
Page 15—(Top photos) International News Photos, New York.
Page 22—York Ice Machinery Corp., York, Pa.
Pages 23-27—Scheibel & Kerr, Pittsburgh, Pa.
Page 40—Underwood & Underwood, Washington, D. C.
Page 41—Armstrong Cork Company, Lancaster, Pa.

DEPENDABLE VALVES

Offer RESPONSIBILITY . . in MEAT PROTECTION

One room at Brandon Packers, Ltd., showing Unit cooler with No. 205 A-P Thermostatic Expansion Valve.

New Refrigeration Plant of "The Brandon Packers, Ltd.," Brandon, Manitoba, Canada.

A-P Model 205 Thermostatic Expansion Valves. 16 of these Valves and 2 Model 210 Valves were used at Brandon.

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★ Like the majority of leading Jobbers the world over, Winnipeg Refrigerator Parts Company have good reason for recommending and selling A-P DEPENDABLE Valves. A letter recently from Mr. James Gibson, Manager, outlined some of these reasons —

★ "It is approximately four years since we began stocking A-P Products, and to say we are satisfied in every way with them is putting it rather mildly . . . We get further satisfaction from passing these same products over the counter to our customers, knowing that they are assured of DEPENDABLE operation with them."

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